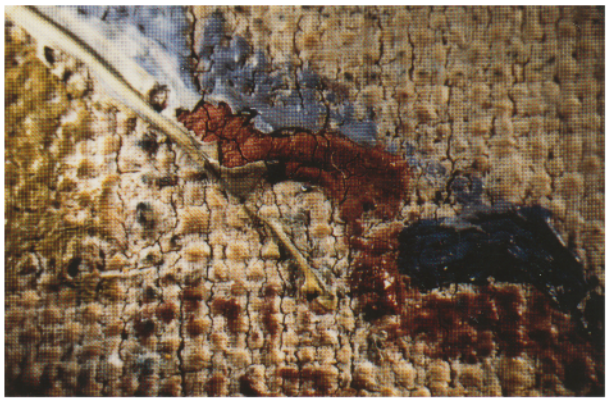
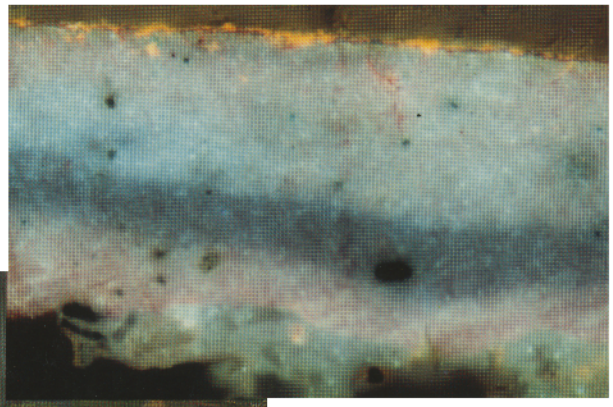
A CLOSER LOOK



Technical and
Art-Historical Studies on Works
by Van Gogh and Gauguin



CAHIER VINCENT 3

A CLOSER LOOK

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Rijksmuseum Vincent van Gogh
in cooperation with the Vincent van Gogh Foundation

A CLOSER LOOK

Technical and Art-Historical Studies on Works by Van Gogh and Gauguin

Edited by Cornelia Peres, Michael Hoyle and Louis van Tilborgh

With contributions by Mette Marie Bang, Paolo Cadorin,
Judith Hofenk de Graaff, Vojtěch Jirat-Wasiutyński,
Cornelia Peres, Carol Stringari, H. Travers Newton

Waanders Publishers, Zwolle

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Foreword

This CAHIER VINCENT examines two recent restoration projects involving works in the collection of the Van Gogh Museum (Vincent van Gogh Foundation): Gauguin's *Portrait of Vincent van Gogh Painting Sunflowers*, which has not been on display for several years because of the deterioration of its jute support, and Van Gogh's Arles triptych of orchards, consisting of *The Pink Orchard, Peach Trees in Blossom* and *The White Orchard*. These restorations, which were carried out on the eve of the 1990 Van Gogh centenary, brought a great deal of new information to light and gave us a deeper understanding of the artist's working method.

The purpose of the CAHIERS VINCENT series is to make source material available to the international community of Van Gogh scholars. This latest volume, which presents the results of restoration projects, departs from that aim to the extent that this time it is not documents that are the primary source, but some of the artist's own paintings, which have yielded a valuable insight into the way they were executed. There is a growing realisation that the pictures in our care have undergone a considerable transformation since they were painted over a century ago. Leaving aside deliberate interventions during earlier conservation treatments, it has been time itself that has wrought the greatest changes. Many pigments, for example, have lost much of their original hue, which has occasionally brought about dramatic shifts in the balance between different passages within a painting. We have to be fully aware of these discolourations if we are to interpret the present image correctly. With an artist like Van Gogh, who was intensely interested in colour theory, it is essential to supplement the evidence of one's own eyes with the knowledge obtained from specialists.

The Van Gogh Museum's conservator, Cornelia Peres, was responsible for the general concept of this CAHIER, and for inviting the international group of contributors, comprising conservation specialists, scientists and art historians. Among these I would like to single out Paolo Cadorin, not least because Ms. Peres received her first training under his guidance.

On behalf of the joint editors, Cornelia Peres and Louis van Tilborgh, I would like to express our debts of gratitude to all those who have been directly or indirectly involved in the conservation treatment of the works under discussion, and in particular to guest conservators Carol Stringari and H. Travers Newton, conservation assistant Mette Marie Bang, art historian Vojtěch Jirat-Wasiutyński and, last but not least, to our colleagues at the Centraal Laboratorium in Amsterdam. During the editorial stages this CAHIER benefited immensely from the expert advice of conservator IJsbrand Hummelen and translator Michael Hoyle. René Gerritsen carried out most of the technical photography in the Van Goghmuseum. As with the previous volumes in this series, we are grateful to the Vincent van Gogh Foundation for its financial support.

Ronald de Leeuw
Director Rijksmuseum Vincent van Gogh

Note for the Reader

Most of the articles were written before March 1990, so subsequent literature on nineteenth-century painting techniques, most notably the exhibition catalogue *Art in the Making. Impressionism*, London (National Gallery) 1990-91, is not cited. Nor has use been made of the renumbering of Van Gogh's letters in the recent Dutch edition, *De brieven van Vincent van Gogh*, ed. Han van Crimpen and Monique Berends-Albert, The Hague 1990.

The following abbreviations are used throughout this CAHIER.

The F numbers refer to the relevant catalogue numbers in J.-B. de la Faille, *The Works of Vincent van Gogh, Paintings and Drawings*, Amsterdam 1970.

The W numbers refer to the relevant catalogue numbers in G. Wildenstein and R. Cogniat, *Paul Gauguin*, vol. 1, Paris 1964.

Number of cited letter [ ] in *The Complete Letters of Vincent van Gogh*, 3 vols., London 1958

GAC
Letter in Douglas Cooper (ed.), *Paul Gauguin: 45 Lettres à Vincent, Theo et Jo Van Gogh*, Collection Rijksmuseum Vincent van Gogh, Amsterdam, The Hague & Lausanne 1983.

Jirat-Wasiutyński *et al.*
Vojtěch Jirat-Wasiutyński, H. Travers Newton, Eugene Farrell and Richard Newman, *Vincent van Gogh's 'Self-Portrait Dedicated to Paul Gauguin': an Historical and Technical Study*, Cambridge (Mass.) 1984.

CL
Central Research Labatory for Objects of Art and Science.

The following definitions of analytical techniques are given relative to their use for the investigation of artists materials. This analytical instrumentation has been employed for many years in the scientific community for different purposes and is presented here only in the service of conservation science.*

EDX
Energy dispersive x-ray analysis is useful for the detection of elements present in a pigment sample or cross-section of the paint layer. For cross-section analysis, it is particularly applicable for layer by layer characterization. The outcome of the elemental analysis in conjunction with optical microscopy can lead to the determination of the actual pigments. The technique employs an electron beam from an SEM (scanning electron microscope) which generates X-rays at a specific point of the specimen. The resultant X-ray emission spectrograph displays the characteristic energies of the elements present. The information gained is both qualitative and quantitative.

FTIR
Fourier transform infrared-spectrometry is an especially effective analytical technique for the determination of organic and inorganic materials such as pigments, binding media and synthetic resins. The method is chosen for the high sensitivity and resolution. FTIR involves the coupling of an optical system of analysis with a computer which transforms the information gained to produce a high quality spectrum on a graphic chart. The peaks are specific to the chemical functional groups present. The infrared region spectral chart is

characteristic for any given compound. This information is then compared by the computer to reference standards for positive identification of the substance.

LMA

Laser-microspectral analysis is another method of elemental analysis to determine the individual elements present in a cross-section or paint sample, in a similar way to EDX. With a specialized microscope, an area of a paint layer is selected and a laser pulse is used to vaporize that point. Every element in nature emits a characteristic radiation when vaporized at a high temperature. With LMA, this results in an emission spectrographic chart. The information is only useful in conjunction with other analytical techniques for identification of the pigment type.

SEM

Scanning electron microscope is an instrument capable of magnifications of up to 100,000 x. By use of a high energy electron beam, electrons on the surface of the sample are scattered and used to generate a video image of the topography of the sample. A considerable depth of field can be achieved in 3-dimensional effect. Scanning electron microscopes usually have an EDX analyzer attachment for microanalysis of the sample. See EDX.

TLC

Thin-layer chromatography is one of several chromatigraphic techniques by which complex mixtures of organic compounds can be separated and identified. TLC is particularly useful for the identification of red and yellow dye-stuffs, organic pigments and binding media such as resins. The process consists of a stationary and mobile phase: a thin layer of adsorbant such as silica gel on an inert plate such as glass, serves as the stationary phase. A drop of the solution to be tested is placed on the edge of the plate that is then dipped in the appropriate solvent which is the mobile phase. The various components of the sample are measured by the relative distances traveled by the separate constituents which are then identified by comparison with reference standards.

XRD

X-ray diffraction analysis is useful for the identification of organic and inorganic substances in crystalline form. Most pigments are metallic salts and of a crystalline nature, such as lead white or chrome yellow. With this technique, a finely crushed sample is mounted on a glass rod and irradiated by a beam of monochromatic x-rays in a specially designed camera. Because of the regular arrangement of the atoms in a crystalline structure, an identifiable 'fingerprint' pattern is generated on a strip of film. The reflected x-rays appear as a series of black lines which are characteristic of a specific substance by their placement and intensity.

* Compiled by Gwendolyn P. Jones

1 Vincent van Gogh, *Two Children*, 1890. Private collection. Photograph in normal light taken after conservation treatment. On both sides of the painting are vertical strips with a pink tone. This colour is seen nowhere else in the picture. Before the treatment of 1967, these two strips of original, painted canvas had been folded over the left and right edges of the stretcher, giving the painting the dimensions of 51.5 x 46 cm. This photograph documents the state of the painting after it had been restored to its original size.

11 Cuno Amiet, copy after Vincent van Gogh, *Two Children* (F 784); oil on canvas, 52 x 46 cm; private collection. Executed in 1907, this is an exact copy of Van Gogh's painting in its reduced size of 51.5 x 46.5 cm, as it was before the conservation treatment of 1967. It gives an idea of the appearance of the Van Gogh in 1907; for instance, some of the pink colour in the background is still present.

Colour Fading in Van Gogh and Gauguin

Paolo Cadorin

One is aware that painting materials evolve with time. They take on an appearance which is specific to the pigments and techniques used in the various epochs. The relationship within the tonalities change, and some pigments are subject to environmental influences, especially the effect of light.

Artists of the Gothic period and the Renaissance used colours whose stability had already been ascertained and, thanks to long workshop experience, they chose them in accordance with the medium in which they wished to bind them. They were also aware of their specific properties, for instance their resistance to various ambient influences. The present condition of these paintings testifies to the excellence of the techniques employed by these artists.

At the beginning of the sixteenth century, when the proportion of drying oils in the medium gradually increased, materials underwent a new type of aging. This process usually induced darkening. Twentieth-century observers are so accustomed to this darkened appearance that even famous experts, art historians or specialists could be misled as to the artist's true intentions.

This calls to mind the curses pronounced against the restoration of the Sistine Chapel: the darkening of Michelangelo's frescos was not due to any change within the paint material itself, but to the soot and other deposits from the burning of candles and similar sources of pollution – not to mention some unfortunate former conservation treatments. This superficial accumulation of grime has given the fresco a misleading appearance similar to that of oil paintings of the same period. The fresco is still in a good condition, apart from limited losses in the plaster. The freshness of the fresco colours recovered after the recent cleaning gives one an idea of how bright and luminous contemporary oil paintings must have been.

Another example of colour alteration is illustrated by the Tintoretto fragment of three red apples and green leaves, discovered by chance during the 1905 restoration in the Scuola di San Rocco in Venice. The fragment was part of a frieze with the heraldic arms of the great schools, and putti holding garlands of flowers and fruit, and had been protected from light and pollution by being folded under another part of the frieze. The colours had remained unaltered, and retained their original intensity.[1]

Reading about painting conservation, one is too often told about paintings that have been brought back to their original freshness, as though they had just come from the artist's studio. This illusion comes from a misunderstanding of the inevitable impact of time on the materials that constitute works of art. It is necessary to have a profound knowledge of a painter's technique in order to get an idea of his vision at the moment of creation. Equally essential is the historical knowledge concerning the artist's intent, in order to be aware of the chromatic change of his paintings.

Generations of scholars have studied the works of the past, examining and comparing them, and have arrived at conclusions that are well known to us today. Yet we have far less information about works executed in the last 100 or 150 years, which does not mean that they have been less subject to change. We often wonder, for instance, if certain colours have not faded – a phenomenon that is well known in watercolours and tapestries. Jean Leymarie, who studied Van Gogh's oeuvre in depth,[2] mentioned a strong alteration of certain chrome yellows, but to the author's knowledge there has as yet been no specific documentation of such a change of chrome yellow in Van Gogh's work.[3]

COLOUR FADING IN VAN GOGH

Quite often it is sheer luck that allows us to confirm an intuition by carrying out proper research in order to enlarge our knowledge of an artist's materials. In 1967, a collector brought a painting by Van Gogh to the Kunstmuseum of Basel. The author, who at that time was chief restorer of that institution, found himself confronted with a painting

that suggested colour changes. The question was, were they due to a correction on the part of the artist, or to discolouration?

The painting was one of the two versions of *Two Children* (F 784), which Van Gogh painted at Auvers-sur-Oise in June 1890 (fig. 1, p. 10).[4] The problem was as follows. The original painted canvas had been folded over the right and left edges of the stretcher and attached with tacks in the same way as the unpainted tacking edges of the canvas at the top and bottom of the stretcher (*fig. 1*). As a result, the width of the painting had been reduced by approximately 2,5 cm on each side.

The background colour was mainly of different tonalities of blue in the upper part, and of shades of white in the lower area; whereas the two painted strips folded over the edge of the stretcher were of a violet colour at the top and pink at the bottom (figs. V-VI, p. 18). Was this change caused by discolouration, or the result of an overpaint applied by the artist? A closer examination with a binocular microscope showed a continuity in the ridges left by the brushstrokes that passed over the edge of the stretcher, even where they systematically changed from light-blue to violet and from white to pink immediately after passing over the angle of the stretcher. This ruled out the possibility of an overpaint.

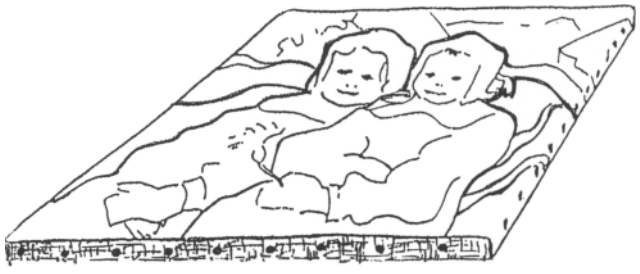
A few minute particles of the paint layer could be taken at the losses and cracks that had occurred on the angle of the stretcher and near the tacks.[5] Microscopic examination of cross-sections of these samples confirmed the presumption that discolouration had occurred. Near the surface, where the pink layer had been exposed to light, the colour had faded; whereas in the depth of the same layer, the colour still had its original brightness (fig. VII, p. 18). And where the pink had not been exposed to light, i.e. on the edges of the stretcher or under a layer of another colour, it had retained all its original intensity, right up to the top (fig. VIII, p. 18).

Chemical analysis by Dr Mühlethaler revealed that the colour in question was an eosine-based lake.[6] Eosine is a colour first made in Paris in 1871 and prepared as an artist's pigment some years later. One of the many names it had been given was 'geranium lake'. It is known from Van Gogh's letters that he used this colour quite frequently.[7]

The findings of the technical analysis of the *Two Children* confirm that the painting originally had a pink component in its background which has since faded. More precisely, the lower area of the background was pink, and the thatched cottages above were violet. This observation seemed to be of some considerable significance for our knowledge of Van Gogh's *oeuvre*, but because the fading had only been demonstrated in a single painting, the author confined himself to an oral communication during the 1967 meeting in Brussels of the ICOM Committee for Conservation.

Many years later, this assertion was confirmed by observations made at an exhibition in May 1988 organised by the Kunstmuseum of Olten, Switzerland, on the influence of Van Gogh on Swiss art.[8] Among the exhibits were three copies of our version of the *Two Children*: one in watercolour on paper (23 x 22.5 cm) by Giovanni Giacometti, and two others in oil on canvas (51 x 46 cm, and 52 x 46 cm) by Cuno Amiet (fig. II, p. 11). Both artists, who were born in the same year (1868), were enthusiastic about avant-garde art, and about Van Gogh in particular, whom they considered a leader. The extraordinary opportunity to examine an original by the great master was given to them in 1907 by their friend Richard Kisling, the art collector and hardware dealer from Zürich. Perhaps acting on the advice of his painter friends, Kisling had just acquired the *Two Children* for 2,000 francs. This was the first painting by Van Gogh to be exhibited in Switzerland. It was left on loan at the studio of the two artists for one year to enable them to study it closely. In their shared studio at Oschwand near Bern, they not only studied it, but also made several copies, including those that were shown at the Olten exhibition.

Both copies by Amiet are the same size as the Van Gogh original was when it was brought to the Basel Kunstmuseum in 1967; Amiet's copies measure 51 x 46 cm and 52 x 46 cm, Van Gogh's painting 51.5 x 46.5 cm. The latter was obviously the model for the copies. It was therefore perfectly logical to deduce that the Van Gogh painting had been mounted onto a smaller stretcher before 1907, the date of its purchase by Richard Kisling. By the time Amiet made his copy, the pink in *The Two Children* had already begun



1. Sketch showing the state of *The Two Children* before the conservation treatment of 1967. The original painted canvas had been folded over the left and right edges of the stretcher and attached with tacks in the same way as the unpainted tacking edges of the canvas at top and bottom.

111 Paul Gauguin, *Among the Lilies*, 1889. Private collection.

IV Unknown artist, copy after Paul Gauguin, *Among the Lilies*. Private collection.

its fading process. The nuances Amiet so faithfully copied can tell us about on the state of Van Gogh's picture at that time. It is very likely that Amiet did not use geranium lake, but another colour that was more resistant to light.

DISCOLOURATION IN A PAINTING BY GAUGUIN

At the end of 1982, a collector of paintings of the Pont-Aven School brought a picture to the Basel Kunstmuseum[9] that resembled Paul Gauguin's *Among the Lilies*, which was on loan to the museum (figs. III-IV, p. 14-15).[10] The collector had bought the work in Denmark from the family of a painter of the Pont-Aven School, despite the fact that it was in very poor condition. The painting was then restored. The canvas had been lined with starch glue and mounted onto a new stretcher, and the painting itself had been heavily varnished. This intervention made it look quite different from the Basel Gauguin, which was still in its original, unvarnished state.

A comparison of both pictures revealed a close correspondence. The compositions were identical: the same landscape seen from the same vantage point, with the same houses and figures. The paintings were of roughly equal size, and the canvases were of a matching type and certainly of the same period.

One of the most obvious differences, though, was in the brushwork. The painting from the Basel museum was done with lean paint, applied in short narrow parallel strokes with low impasto. The paint of the work brought in for examination was richer, and had been applied in broad brushstrokes with higher impastos. The canvas was visible in several places, in a manner which at first glance suggested an unfinished work. The most striking difference was that in the Gauguin, quite a large part of the soil in the foreground with the dog and the child was of a greyish-blue tone, whereas in the other picture the same area was of a definite pink and violet tone (figs. IX-X, p. 19).

The author's original supposition was that the painting submitted for examination was a copy by one of the Pont-Aven painters after an original by Gauguin. How, though, to explain the dramatic colour difference in the foregrounds? It was difficult to imagine that a student would take such liberties with the foreground colouring when copying a work by the master.

Yet the handling and the mediocre quality of the work from Denmark clearly showed that it could not be an original by Gauguin. Was it then possible to attribute this difference in foreground colouration to the fact that the original by Gauguin had faded? If that were the case, the copy would give us precious information of its original colour. This hypothesis was suggested to the author by the case of the Van Gogh studied 20 years earlier. His search for a pink component which he believed to have faded was successful: on the lower edge of the painting, where a narrow strip was protected from light by the frame, one could see several traces of pink colour (fig. XI, p. 19).

This presumption of discolouration had to be corroborated by scientific analysis, and once again Dr Mühlethaler confirmed the phenomenon of fading (fig. XII, p. 19). Out of respect for the excellent condition of the painting, only extremely small samples could be taken. Although they were too small for conclusive results, they still indicated that 'the presence of an eosine-type lake, such as the pigment known as "geranium lake", should be considered a strong possibility.'

The suggestion that Gauguin used geranium lake when he painted *Among the Lilies* is bolstered by the fact that a few months before he had spent some time in Arles together with Van Gogh.[11]

In the light of the above it can be concluded that the copyist had been faithful to Gauguin's work, which originally had a pink and violet foreground, and not the greyish-blue one seen today.

CONCLUSION

It is certain that the two examples of pink discolouration described above are not isolated cases. At the end of the nineteenth century, eosine had been the base product in the manufacture of several red lakes, which were sold under a variety of fanciful names.[12] Moreover, we must remember that all kinds of synthetic colorants were introduced in the second half of the nineteenth century,[13] many of which were also used as artist's pigments. To learn about their nature, their resistance over a period of time, how long they remained on the market and which artists used them, would require research on a large scale.

In the case of Van Gogh, the precious document of his correspondence is an indispensable source of information for the researcher wishing to discover how he viewed his paintings, what materials he had used, and how his paintings looked at the time he painted them.

For instance, among the colour orders which Vincent regularly sent to his brother between September 1888 and April 1890, he asked for no fewer than 2 tubes of 'laque géranium'.[14] This of course does not include those he had

asked for on 'separate lists' included with letters to his brother.[15]

The richness of his vocabulary to describe colours containing pink is astonishing, as is the number of times in his letters from Saint-Rémy, for instance, he mentions tones like 'violet', 'violacé', 'lilas', 'lilas pâle', 'lilas tendre', 'lilas rompu', 'rose', 'lilas uni', 'gris ou rose', 'jaune tourne au rose', 'rose-vert', 'violet-rose', etc. Yet his paintings of that same period now appear to be mainly in the tones of cold pale green and light blue.

Van Gogh's chromatic descriptions of his paintings are very precise. But in certain cases one notes sudden discrepancies between the painter's description and the work as it looks today. For example, in his description of *The Tarascon Stagecoaches* of 1888, Van Gogh describes the walls of the houses in the background as being 'pink and yellow';[16] today they appear to be greyish white and yellow. About *The Ravine* of 1889 he says: 'it is all violet'.[17] The painting today appears in different shades of grey. Describing the *Portrait of Dr Gachet*, he speaks of 'a digitalis plant with purple flowers'.[18] In both versions of that subject, these flowers are now blue, with only a few mauvish accents.

Extensive research would be necessary to determine how far our vision of the work of Van Gogh and of the art of his time is betrayed by chromatic changes in the pictorial material. Much has been written about colour in the work of Vincent van Gogh, but perhaps those opinions should be reconsidered in the light of the examples given above.

NOTES

This article is an expanded version of P. Cadorin, M. Veillon and B. Mühlethaler, 'Décoloration dans la couche picturale de certains tableaux de Vincent van Gogh et Paul Gauguin', ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, pp. 267-73. The present essay could not have been written without the generous assistance of Monique Veillon and Bruno Mühlethaler.

1. See F. Valcanover, *Jacopo Tintoretto e la Scuola Grande di San Rocco*, Venice 1983, p. 21 (ill.).

2. J. Leymarie, Van Gogh, Paris 1951.

3. See H. Kühn, 'Farbmaterialien, Pigmente und Bindemittel', *Reclams Handbuch der künstlerischen Techniken*, vol. 1, Stuttgart 1984, p. 28: 'Vor allem ältere Sorten Chromgelb sind nicht lichtbeständig, sie dunklen im Laufe der Zeit nach und werden zum Teil braun oder grün. Heute gibt es besser lichtbeständige ("stabilisierte") Chromgelbsorten.'

4. *Two Children*, oil on canvas, 51.5 x 46.5 cm; private collection. This version is commonly called *The Smiling Children*; the other (F 783), 51 x 51 cm, is in the Musée d'Orsay, Paris. *The Smiling Children* was returned to its original size of 51.5 x 51.5 cm when the conservation treatment was carried out in 1967.

5. The cross-sections and chemical analysis were made under the direction of Dr B. Mühlethaler at the Chemisch-Physikalisches Labor of the Landesmuseum in Zürich. For the results see P. Cadorin, M. Veillon and B. Mühlethaler, 'Décoloration dans la couche picturale de certains tableaux de Vincent van Gogh et de Paul Gauguin', ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, pp. 267-73.

6. See R.J. Gettens and G.L. Stout, *Painting Materials*, New York 1966, p. 114: 'Eosine [...] was first made by Caro in 1871. [...] It was formerly used for preparing red inks of a very fine scarlet hue, but is not a fast colour; it fades rapidly in sunlight. "Geranium lake" is the name sometimes given to a brilliant bluish lake made by precipitating eosine on an aluminate hydrate base.'

7. During that same year of 1967, it had also been possible to document the presence of eosine in a colour tube from the Gachet Bequest, together with the famous palette Vincent had used to finish *Marguerite Gachet at the Piano* (F 772), one of his paintings that has also quite definitely suffered considerable fading. The colour tubes were kindly put at our disposal by the former Musée du Jeu de Paume in Paris, thanks to the generous assistance of Mme Adhémar, curator. The chemical analysis was carried out under the supervision of Mme S. Delbourgo at the Laboratoire des Musées de France, directed by Mme M. Hours.

8. P. Killer, exhib. cat. *Copain Vincent – Die Wirkung van Goghs auf die schweizer Kunst*, Olten (Kunstmuseum) 1988.

9. Unknown artist, subject identical to Gauguin's *Among the Lilies*, ca. 1890, oil on canvas, lined, 94 x 73 cm, not signed or dated; Switzerland, private collection.

10. Paul Gauguin, *Among the Lilies*, 1889, oil on canvas, 92.5 x 73.5 cm; signed and dated at bottom right: P. Gauguin. At that time on loan from a private collection to the Kunstmuseum, Basel. Sold at Sotheby's in New York on 16 November 1989 to a Japanese art dealer.

11. Gauguin had stayed at Van Gogh's house in Arles from 20 October to 24 December 1888.

12. See Kühn, op. cit. (note 3), p. 25.

13. See Kühn, op. cit. (note 3), p. 25: 'Kurz nach der Mitte des 19. Jh. wurden die ersten synthetischen organischen Farbstoffe aus Anilin, Phenol und Benzol hergestellt. Man nannte sie Anilinfarbstoffe oder Teerfarb-stoffe [...] der erste Teerfarbstoff ist das 1856 von William Perkin entdeckte Mauvein.'

14. Vincent's orders of geranium lake; from Arles, September 1888, '6 tubes moyens' [541a]; October 1888, '10 tubes moyens' [551]; April 1889, '2 tubes moyens' [584]; April again, '6 petits tubes' [584]; from Saint-Rémy, September 1889, 'un grand tube laque ordinaire' [604]. At the end of the same month he returned to the 'laque géranium', asking more precisely: 'Puis (mais chez Tasset) 2 Laque géranium, tubes moyen format' [629].

15. One of these separate lists is mentioned in letter 645: 'La commande de couleurs ci-jointe'.

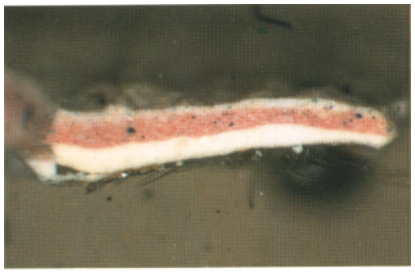
16. *The Tarascon Stagecoaches* (F 478a), letter 552.

17. *The Ravine* (F 662), letter 610.

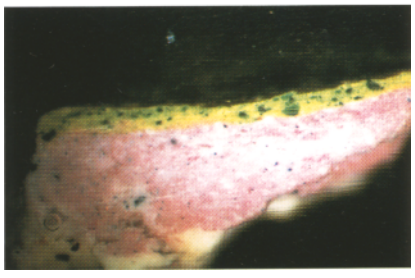
18. *Portrait of Dr Gachet* (F 754), Paris, Musée d'Orsay; and idem (F 753), now in Tokyo, Seÿi Togo Memorial Yasuda Kasai Museum of Art; letter 638. The digitalis flower appears blue in both versions.

v Macrophotograph of the lower left edge of *The Two Children* after conservation. The vertical strip with a pink tonality corresponds to that part of the canvas that had been folded over the edge of the stretcher. It has here been returned to the picture plane. The continuity in the ridges left by the brushstrokes is proof that the pink and blue areas belong to the same paint layer, and rules out the possibility of an overpaint. The two white spots within the pink strip are unfinished fillings of the holes left by the tacks.

vi Macrophotograph of the lower right corner of *The Two Children* after conservation.



vii Sample taken from *The Two Children* at the edge of the crack caused by the ridge of the former stretcher. The structure from bottom to top consists of a white layer of chalk ground and a pink layer containing a few blue pigments which becomes progressively whiter towards the top, with only the blue pigments remaining. Cross-section, 65 x.

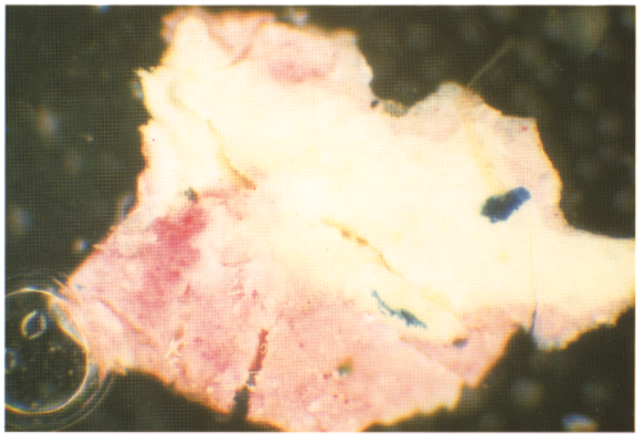


viii Sample taken from *The Two Children* in the area of a green brushstroke applied over the bluish background. One notes, from bottom to top: a thin part of the chalk ground, the rest of which has broken off; a thick pink layer which is the same shade of pink through-out; a green layer that has protected the pink from fading under the influence of light. Cross-section, 120 x.

IX Paul Gauguin, *Among the Lilies*. Detail of the foreground at lower left, behind the dog's legs, showing the tone of the foreground as it is today.

X Copy after Gauguin's *Among the Lilies*. Detail of the foreground at lower left, documenting the colour of the foreground as it probably was in Gauguin's original before it faded.

XI Macrophotograph of the lower edge of Gauguin's *Among the Lilies*, which is normally covered by the frame. The part of the paint layer protected from light under the frame shows brushstrokes that have remained pink.



XII Microphotograph (290 x) of a colour fragment from Gauguin's *Among the Lilies* containing pink and faded pink, taken in the pink area seen in fig. XI.

VAN GOGH'S TRIPTYCH OF ORCHARDS IN BLOSSOM

Introduction

By 1989 Van Gogh's triptych of flowering fruit trees in the Van Gogh Museum – *The Pink Orchard*, *Peach Trees in Blossom* and *The White Orchard* – had lost much of its original freshness. The once spirited impasto had gone, as had the original colour contrasts. The three paintings were brought to the conservation laboratory for examination, and for an assessment of whether they could be treated in preparation for their inclusion in the 1990 retrospective in Amsterdam.

Beneath the varnish there was a hazy grey layer which proved difficult to remove. Cornelia Peres, the museum's Conservator of Paintings, and guest conservator Carol Stringari from the Museum of Modern Art, New York, were given the task of finding the most satisfactory way of restoring the paintings. Their discussions, and consultations with scientists at the Central Research Laboratory for Objects of Art and Science in Amsterdam and with the museum curators, led to the decision to investigate methods for removing the coatings and residues. The purpose of cleaning the pictures was to attain some semblance of unity in the restored surfaces, while also addressing the unique problems and aesthetics of each work individually. The determination and removal of the grey surface layers turned out to be a complex affair, but they were safely eliminated by applying the principles and approach developed by the biochemist Richard Wolbers. Riet Karreman, Wilma Roelofs and Matthijs de Keijzer of the Central Research Laboratory did the requisite analyses and tests, coordinated by Judith Hofenk de Graaff. The team of investigators followed a joint research strategy designed to provide the conservators with the methods of analysis most appropriate to resolving the problems facing them. The treatment of the three paintings was finally brought to a successful conclusion, with extra assistance from conservator Mette Marie Bang. The following essays deal with various aspects of the restoration, and consider the art-historical and technical problems involved.

I

II

III Vincent van Gogh, *Peach Trees in Blossom*, 1888, 80.5 x 59.5 cm. Amsterdam, Rijks-museum Vincent van Gogh (Vincent van Gogh Foundation).

I Vincent van Gogh, *The Pink Orchard*, 1888, 64.5 x 80.5 cm. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

II Vincent van Gogh, *The White Orchard*, 1888, 60 x 81 cm. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

An Impressionist Concept of Painting Technique

Cornelia Peres

By 1888 spring landscapes had become a popular theme with all the Impressionists. Pissarro and Monet, in particular, had never tired of painting this seasonal subject since the late 1860s. Bright little dots of paint, rendering the various blossoms of flowering trees, almost literally expressed the vibration of the air on their canvases. This sensation of air, light and colour in springtime was especially rich in the south, which is why it became almost routine for artists to take their holidays under the southern sun by the late 1880s.

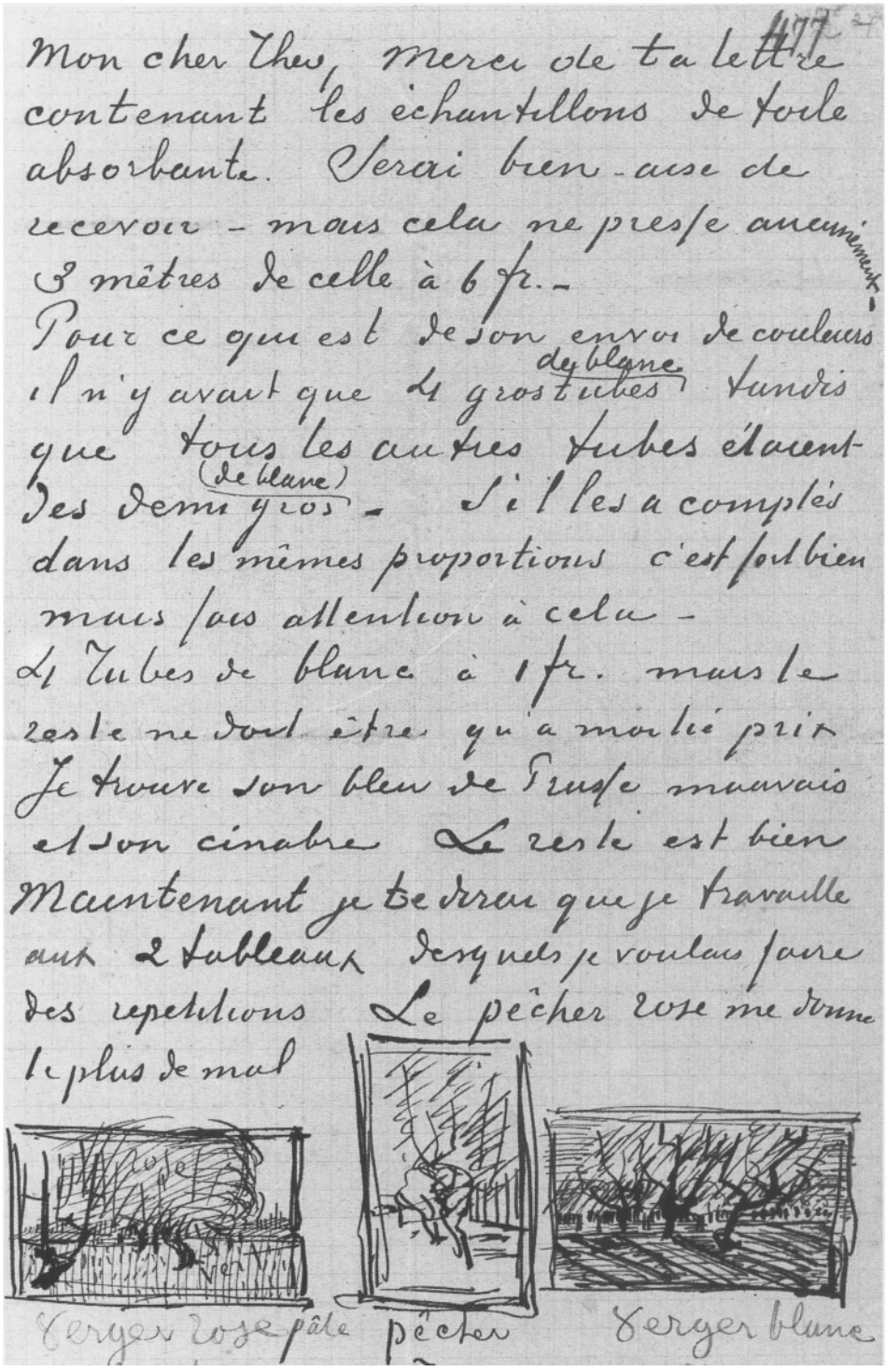
Vincent van Gogh combined both traditions when, within weeks of arriving in the south of France in February 1888, the overwhelming spring in Provence brought him to a fever pitch of creativity: 'I'm up to my ears in work, for the trees are in blossom and I want to paint a Provençal orchard of astounding gaiety' [473]. He was inspired by blossoming fruit trees of every kind, and set himself the task of painting as many of them as possible before their flowering season was over [474, 475]. The 14 pictures of this subject, which he completed in less than a month, were not so much a planned series as experimental studies and variations on a theme.

Such variations had become increasingly popular, and were associated with the custom of painting outdoors, where daily and seasonal changes evoked constantly varying impressions of light and space.[1] The swift atmospheric changes made it necessary to work sketchily, and the result therefore had the character of an *étude*. If the artist's aim was to produce a more important painting to sell or exhibit, the study was usually elaborated and worked up in the studio under stable conditions, unaffected by wind, rain or clouds. When Monet, for example, returned from a three-month stay in Antibes in 1884, where he produced about 50 paintings, he wrote to Durand-Ruel: 'I haven't a single canvas which doesn't need to be looked at again and carefully retouched, and that cannot be done in a day. I need to see all my work peacefully, in the right conditions. I have worked for three months in front of nature, taking great pains and never feeling satisfied, and it's only here during the last few days that I can see what to make of a certain number of paintings. You must realise that among the large number of études I have made, not all can be delivered to the trade; some could be very good, I think, and others, even though a bit vague, could turn into good things if they are carefully retouched, but, I repeat, this cannot be done from one day to the next'.[2]

This desire to turn rapidly executed studies into mature and saleable *tableaux* was expressed in a letter written by Vincent when he was working on his orchard series, in which he described the disadvantages of working out of doors in Arles: 'And the weather today has been fine. This morning I worked on an orchard of plum trees in bloom; all at once a fierce wind sprang up, an effect I had never seen before, and returned at intervals. The sun shone in between, and all the little white flowers sparkled. It was so lovely. My friend the Dane came to join me, and I went on painting at the risk and peril of seeing the whole show on the ground at any moment – it's a white effect with a good deal of yellow in it, and blue and lilac, the sky white and blue. But as to the execution of what one paints outside like this, what will people say? Well, we shall see. [...] If I can manage to learn to work out studies from nature on a fresh canvas, we should profit by it, as far as a likelihood of selling is concerned' [476].

This essay focusses on three paintings in this ambitious series of flowering fruit trees: *The Pink Orchard* (F 555), *Peach Trees in Blossom* (F 404), and *The White Orchard* (F 403) (figs. I-III, pp. 22-23). In a letter of mid-April, while working on the orchards, he referred to these three pictures as a triptych in a related series of nine works which would have the effect of a decorative programme. It was intended as a gift for Theo [477].[3] Six were more or less finished, while three were still in the 'stage of an embryo or foetus' [477].[4]

The planned arrangement of the triptych is given in a sketch in the same letter (*fig. 1*). *Peach Trees in Blossom*


477
Mon cher Theo, merci de ta lettre
contenant les échantillons de toile
absorbante. Serai bien aise de
recevoir - mais cela ne presse aucunement -
3 mètres de celle à 6 fr. -
Pour ce qui est de son envoi de couleurs
il n'y avait que 4 gros tubes de blanc tandis
que tous les autres tubes étaient
des demi gros (de blanc) - S'il les a comptés
dans les mêmes proportions c'est fort bien
mais fais attention à cela -
4 Tubes de blanc à 1 fr. mais le
reste ne doit être qu'à moitié prix
Je trouve son bleu de Prusse mauvais
et son cinabre Le reste est bien
Maintenant je te dirai que je travaille
aux 2 tableaux desquels je voulais faire
des répétitions Le pêcher rose me donne
le plus de mal
Verger rose pâle
pêcher
Verger blanc

1. Vincent van Gogh, *Sketch in Letter 477*. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

formed the centrepiece, with The Pink Orchard on the right and *The White Orchard* on the left. The latter two were probably painted at the beginning of April. *The Peach Trees*, a copy after *Souvenir de Mauve* (F 394), dates from mid-April (fig. IVa, p. 50), which is when he conceived the idea of a triptych.

Van Gogh viewed each of the three pictures differently. He considered the repetition of the *Souvenir de Mauve* to be less successful than the original, and although he felt that it might improve with time [486] he did not sign it. At first he counted the other two, which do have a signature, as among the best of his output during the first months of his stay in Arles [485]. Later, though, he only spoke of *The White Orchard*, which he felt should be framed, unlike *The Pink Orchard* [492].[5]

Van Gogh's series of orchards in blossom can be regarded as symbolising the brothers' ideas of the direction that modern art should take, with a leading role being reserved for the Impressionists. His guiding light was Monet, who exhibited in Theo's Montmartre gallery in May [483]. In his letters Vincent repeatedly refers to the Impressionists as his inspiration,[6] although it must be said that he used the term very loosely. He regarded his own contemporaries as members of the group, as can be seen from a letter to his sister Willemien, in which he goes into some detail on Impressionist techniques in order to clarify his own position in relation to his fellow artists: 'I tell you this in order to make you understand what kind of tie exists between me and the French painters, who are called Impressionists – that I know many of them personally, and that I like them. And that furthermore in my own technique I have the same ideas about colour, even thought about them when I was still in Holland' [W4].

This essay takes a closer look at Vincent's working method, techniques, and the materials used in the three works for the triptych, in which his struggle with Impressionism is so clearly manifest.

CANVAS AND GROUND

When Vincent arrived in Arles and immediately started work, he bought his paint and canvases either at a grocer's or a bookshop. However, they did not have everything he needed, so he wrote to Theo that he was probably going to go to Marseilles 'to see what the situation is there' [464].

Like many other Impressionist painters, Vincent had technical and aesthetic reasons for using canvas with a ground which would absorb the excess oil in order to achieve a 'metier matte'.[7] In his Paris paintings he was still employing a visible, white reflecting ground, while his early Arles pictures show a greater variety than ever before in the

2. Vincent van Gogh, *Orchard in Blossom*, 1888. Edinburgh, National Gallery of Scotland.

use of ground and canvas structure. They are treated differently in each of the three paintings of the triptych. In the *Peach Trees*, for example, the off-white ground can only be seen at certain points along the horizon line and in small bare spots in and around the fence area, where the paint does not cover the ground completely. *The White Orchard* is painted on the same type of canvas,[8] but here the surface paint layer is much thinner and does not entirely cover the ground. In the ploughed fields under the trees the ground shines through the first, light green layer, which was applied so thinly as to be almost washed. Unlike *The Pink Orchard*, which is on a canvas prepared by hand, the other two are on ready-made canvases primed by the manufacturer or colour merchant.

These commercial canvases were available in different standard sizes and several colours.[9] Most were in cooler or warmer tones of off-white,[10] had diagonal or plain weave patterns, and were of various materials (linen, cotton, hemp, etc.), and were either a 'toile ordinaire' (coarse character) or a 'toile fine'. The properties of the ground were important for the painting process, as well as for the effect and stability. The canvas could be a plain woven linen with a thin lead-white and oil ground, which was slightly grainy or 'absorbante', consisting of half oil, half animal glue with chalk and lead white.[11]

Like many other *plein-air* painters, Vincent favoured the standard, machine-made, finely woven linen with a regular and quite tightly woven structure and a creamy, off-white colour imparted by small amounts of yellow, red or brown earth pigments (iron oxides) and bone black. Fillers were lead white, chalk and barium sulphate.[12] The ground was thin, which a colour merchant's handbook of 1883 described as adapted to broad and rapid painting.[13]

At the beginning of March Vincent wrote to his brother saying that he had 'bought some coarse canvas here, and had it prepared for matte effects' [467]. It seems, then, that he was not happy with the primed canvases from the local supplier. He was also impatient at what he considered to be the unnecessarily long time it took him to deliver hand-prepared canvas, and so a little later, around 4 April, he asked his brother to get in touch with his old suppliers in Paris. They were Julien-François Tanguy ('Père' Tanguy), whose shop was one of the most important meeting places of many Impressionists (at 14, later 9, rue Clauzel), and Tasset et L'Hôte, 'Fabricant de couleur fines – Toiles à tableaux – Appareils et founitures pour la photographie – Dourure et encadrement' (31, rue Fontaine).[14] 'You will please ask old Tasset or old l'Hôte his absolutely lowest price for 10 yards of his canvas prepared with plaster or absorbent and let me know the result of the discussion'. And he complained: 'The colour merchant here made me absorbent canvas, but he is so slow about it that I decided to have it sent from Paris or Marseilles and I have given up all hope of getting him to do it, having lost all patience with him' [475].[15]

He did not receive the absorbent canvas until approximately 1 May [480],[16] and in the meantime had to make do with industrial primed canvases which he had brought with him from Paris and with canvas prepared for matte effects by the local grocer.[17] At this stage Vincent was not priming his own canvases, as we learn from a letter of mid-May about the consignment he had received: 'Tasset's absorbent canvas would suit me much better if the canvas itself was three times as rough. If you meet the man, try to find out what he uses for plaster. I should not be surprised if he prepared his canvas with pipe clay. If I could find out about this, I think that I could prepare the canvas myself. There is no hurry, but try to find out. I still have 4 meters of canvas 1.20 m. wide, which I bought here, but it is not prepared. Next time I have paints sent, he could put some plaster in the same lot, enough to prepare 4 meters. But there is no hurry yet' [488].[18]

Only two paintings are known for certain to have been executed on that absorbent canvas from the grocer: *The Pink Orchard* from our triptych, and the slightly smaller *Orchard in Blossom* (F 553), now in the National Gallery of Scotland (*fig. 2*).[19] Both paintings, of apricot trees, have some technical similarities. The canvases are of normal woven linen, and their measurements come close to the standard sizes 15 (65 x 54 cm) and 25 (81 x 65 cm).[20] Both have a hand-made ground of an all-over pink hue which does not cover the tacking margins (figs. v-vi, p. 51).[21] Quite extensive areas of the ground layer were left bare, so that its tint is incorporated in the colour composition, where its tonality makes an important contribution to the final effect.

The medium of the ground of *The Pink Orchard* has been identified as egg yolk,[22] which is rather unusual.[23] The fillers of the ground in this painting are baryte (barium sulphate), mixed with calcite (calcium carbonate), zinc, lead white, small amounts of carmine (organic red), and traces of a synthetic organic yellow.[24]

DRAWING ON THE CANVAS

Although no traces of charcoal could be found by microscopic observation, examination of cross-sections or the other analytical techniques applied to the three paintings,[25] we may assume that Vincent nevertheless executed his ini-

3. The Pink Orchard in raking light.

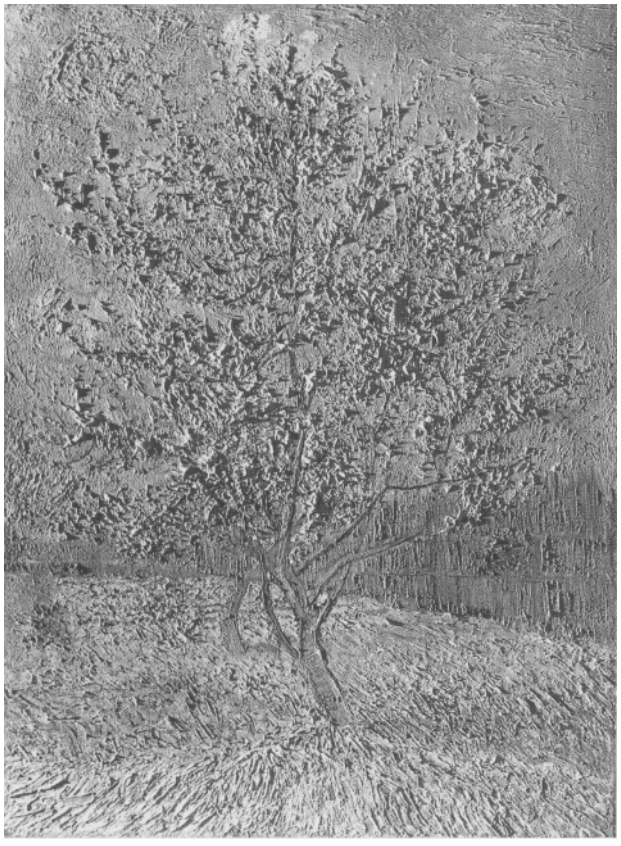
tial composition sketch in charcoal. It was only in September 1888 that he first plucked up the courage to abandon this traditional way of preparing a picture: 'I have deliberately arrived at the point where I will not draw a picture from charcoal. That's no use, you must attack drawing with the color itself in order to draw well' [539].[26]

The first sketch in charcoal was probably done with the aid of the perspective frame which he mentioned in an early letter from Arles, justifying its use by maintaining that earlier masters had employed it [469]. This device had been very important to Vincent from the beginning of his career.[27] 'I think you can imagine how delightful it is', he wrote enthusiastically to his brother in 1882 about the first perspective frame he owned, 'to turn this spy-hole frame on the sea, on the green meadows, or on the snowy fields in winter, or on the fantastic network of thin and thick branches and trunks in autumn or on a stormy day. Long and continuous practice with it enables one to draw quick as lightning – and, once the drawing is done firmly, to paint quick as lightning too' [223].

Vincent's Provençal spring landscapes of six years later prove how fast he was able to paint using this device. After the sketch in charcoal he probably painted the horizon line before laying in the sky. Close inspection of the paint layers shows that there is a quite boldly drawn line running from left to right immediately on top of the priming, marking the primary division of the space to be painted.[28] Much of this very first guideline is disguised by the paint of the ensuing build-up, which fills in the background and structures the foreground.

Over this rough perspective sketch in charcoal he then drew the main compositional structure with the brush, and painted the lines of the trees in either a strongly contrasting or a dark colour. Although he described the motif of *The White Orchard* as 'plum trees, yellowish white, with thousands of black branches' [474], no black pigment was revealed in the technical examination. This is not surprising, for pure black pigment had become very unpopular among the Impressionists,[29] who instead used a variety or mixture of pure colours which approached the intensity of black: ultramarine, a dark red lake, viridian and above all Prussian blue.

Van Gogh regarded this drawing in colour, which preceded the build-up of the picture, as the essence of a painting, as he wrote to Émile Bernard: 'Working directly on the spot all the time, I try to grasp what is essential in the drawing – later I fill in the spaces which are bounded by contours' [B3]. Earlier he had explained to his colleague Horace M. Livens: 'In *color* seeking *life* the true drawing is modelling with color' [459a]. It is for that reason that some of Van Gogh's paintings have a very graphic appearance, as if they had been painted with a quill, and are comparable to his drawings executed at the same time.



4. Peach Trees in Blossom in raking light.

The dark, unmixed colours enabled the artists not only to use their coloured 'drawing' to define the shapes, but also to incorporate it in the final colour composition. In the mid-1870s Monet frequently used carmine lines to accentuate tree-trunks and branches, contrasting them with green foliage. Sisley, too, modelled forms with colour extensively.[30] Vincent's most striking use of carmine and ultramarine shapes is in *The Pink Orchard*, their counterparts in *The White Orchard* being brown and Prussian blue. Perhaps he had an experience comparable to Cézanne's in 1876: 'The sunlight is so fearsome that the objects seem to be silhouetted not just in black and white, but in blue, red, brown and violet'.[31]

The effect of drawing in colour is to emphasise linear structures in a composition, making them more dominant than the dissolved contours and shapes had been in early Impressionist painting. Van Gogh's orchards in blossom incorporate this compositional element, which was probably inspired by Japanese drawing [605].[32]

BRUSHWORK AND PAINT

None of the orchard paintings is uniform in technique. The only thing they have in common is their overall, rather relief-like structure. This absence of a regular style is explained by Vincent in a letter to Émile Bernard: 'At the moment I am absorbed in the blooming fruit trees, pink peach trees, yellow-white pear trees. My brush stroke has no system at all. I hit the canvas with irregular touches of the brush, which I leave as they are. Patches of thickly laid-on color, spots of canvas left uncovered, here and there portions that are left absolutely unfinished, repetitions, savageries; in short, I am inclined to think that the result is so disquieting and irritating as to be a godsend to those people who have fixed preconceived ideas about technique' [B3].

Van Gogh's application of paint was influenced by the speed of his execution. However, he was not always satisfied with the spontaneous character of his works, so back in the studio he altered and reworked the canvases, as he wrote to Theo in his letter about the six works for this related series of orchards. 'I am now trying every day to touch them up and give them a certain unity. I dare hope for three more, matching in the same way' [477].

We cannot determine the exact number of sittings he required for each painting. The paint layer of *The Pink Orchard* has a substantial local impasto, while *Peach Trees in Blossom* has a heavy, overloaded surface throughout (*figs. 3-4*). The latter is a studio replica of the *Souvenir de Mauve* (F 394), so it was not painted spontaneously in the thrill of the moment. Van Gogh wrestled with it for a long time in order to achieve the same satisfying result as in its predecessor. The final surface appearance – almost a heavily modelled relief – clearly reflects this struggle.

Probably only minor corrections were made to *The White Orchard*, the painting which pleased Van Gogh the most and has the most spontaneous look of the three. The overall structure is very balanced.[33] The foreground and background are quite smooth and fluid, only the sparkling dots of the myriad blossoms protrude from the paint surface (*fig. 5*).

The astonishing variety of dynamic surface structures in the three paintings, ranging from smooth to thick and from dry to oily, reflects Vincent's temperament rather than his theoretical concerns. Early in his Paris period he had already started emphasising the impasto in his flower studies, influenced above all by the paintings of Monticelli, whose direct, rapid application of colour showed Vincent how feelings could be expressed by the immediacy of painting quickly.[34] Painting 'in one rush' became almost a criterion

5. *The White Orchard* in raking light.

of quality and experience [502], and one that could not be better demonstrated and mastered than by catching those constantly changing moments of light and colour out of doors. His paintings of orchards in Arles could be regarded as his first extensive trials with this method.

The paintings of orchards should also be seen as the first major experiments in Van Gogh's search for his own place among avant-garde artists after having absorbed their ideas in Paris. Being in the south of France, freed from direct influences, he obviously tried to find his own way among the various expressive possibilities of brushwork. The two extremes within which he set out to discover his own style were, on the one hand, the more abstract, decorative manner of painting (his models here being Japanese prints and the so-called Cloisonists), and on the other hand the Neo-Impressionism of Seurat. The lengths to which he was prepared to go without abandoning the flowing sweep are illustrated by the two outer wings of one of the triptychs of mid-April: *Orchard Surrounded by Cypresses* and *Orchard with Peach Trees in Blossom*, both of which were deliberately painted in a different style (*figs. 6-7*). In the first of the two he was searching for the kind of decorative effect to be seen in stained-glass windows [B3], while in the second canvas he employed a pointillist style, which is very emphatic by his standards but not dogmatic, by applying quite dry paint in little dots [492]. The Neo-Impressionists' laborious system of applying colour in stipples and hatched strokes of varying consistency of paint, from the more fluid and dilute to more solid and stiff, was never taken too literally by Vincent – probably due to his impulsive and impatient character.[35] Van Gogh adopted a cautious middle course between those two extremes in the triptych discussed in this essay.

The execution of the three paintings would have been inconceivable without the encouraging example of the Impressionist painting technique, with its distinctive brushwork and thick dragged paint.[36] How better to render blossoming trees than to use such descriptive brushstrokes, which imitate the painted object?[37] The orchards in blossom almost reached a climax of impasto beyond which only a few later paintings would go.[38]

The differences in impasto between the three pictures cannot be attributed to those Impressionist models and the retouching and reworking alone. Another possible explanation might be provided by the physical composition of the actual paint. For his orchard paintings Van Gogh used large quantity of tube colours, as his frequent orders to Theo show [474, 475]. Like many artists he was aware of the variable quality of such colours,[39] and was therefore very careful in his choice of supplier. Cost was another important factor; always short of money, he tried to achieve the best results for a reasonable outlay.

Tube colours were extremely practical to artists painting out in the open, for they enabled them to transfer their visual stimulation from nature directly onto the canvas,[40] sometimes to the point of literally squeezing the paint from the tube onto the canvas. The shape of some of the dots in

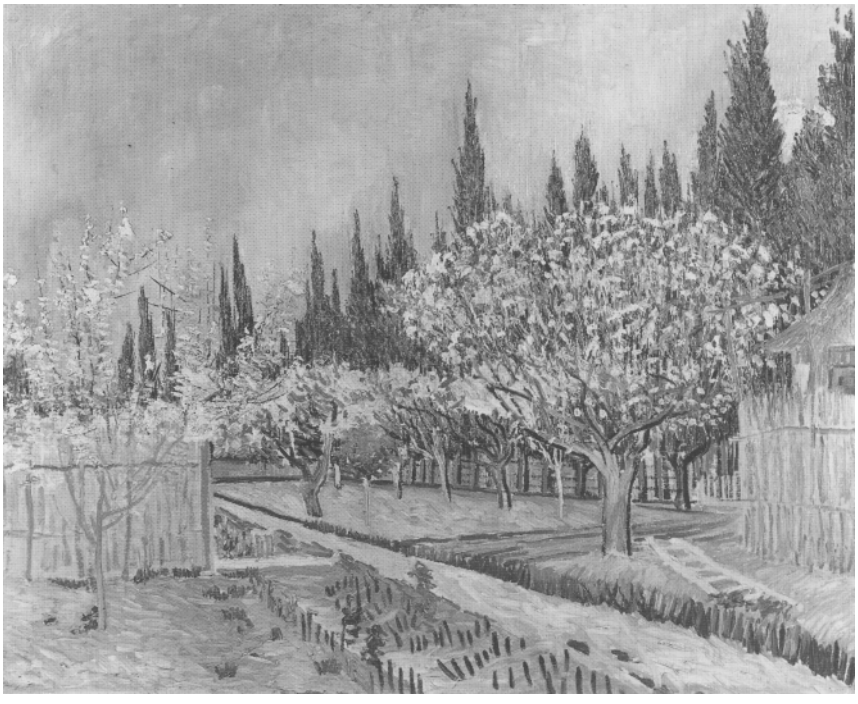
the three orchard paintings seem to have been applied in this way and were then probably remodelled with the brush. This produced a vivid surface texture which allows the spectator to share in the artist's immediacy of sensation. 'What a queer thing the touch is, the stroke of the brush. In the open air, exposed to the wind, to the sun, to the curiosity of people, you work as you can, you fill your canvas anyhow. Then, however, you catch the real and essential – that is the most difficult. But when after a time you again take up this study and arrange your brush strokes in the direction of the objects – certainly it is more harmonious and pleasant to look at, and you add whatever you have of serenity and cheerfulness' [605].

Because of their buttery consistency, undiluted tube colours could be handled with the brush like modelling paste. This was partly due to various extenders, which were added to the paint to keep it soft. Besides aluminium hydrate, zinc stearate and palmates, beeswax could also produce good buttery pastes.[41] Wax was a well-known stabiliser for preventing separation of the oil medium and the pigment.[42] The more wax the greater the amount of oil that has to be added, until finally the tinctorial strength of the colour becomes weakened and its tone and brilliancy reduced. Several artists' manuals mention wax as a paint medium. Delacroix recommended the addition of wax with refined turpentine ('essence rectifiée') to normal paint in order to achieve a matte effect. Experiments with oil and waxy media to produce this result could, however, lead to poor stability and deterioration of the paint layer.

Extenders such as wax were not only necessary for the quality of the paste, but were also very attractive to the paint manufacturers, because the addition of extenders to the tube colours increased the quantity of medium (the cheaper ingredient) in reverse proportion to the amount of pigment (the more expensive ingredient). As each pigment has a different saturation point for oil, the varying amount of medium influences the surface appearance of each colour – some become matte and dull, others glossy. These irregularities increase if the quantity of the medium in relation to the pigment becomes unbalanced. That is to say, some colours become underbound and powdery (with the result that the pigment and the medium lose their adhesion), while others become oversaturated, leading to excess oil appearing on the surface. This was especially problematical for the build-up of the paint layer, and nullified the matte effects which Vincent and other Impressionists were aiming for.[43]

Nevertheless, even Van Gogh's Impressionist models and the technical composition of tube paint do not fully explain the great variety of his impasto. It is possible that he experimented with the drying times of paint blobs on his palette, which would have given them varying consistencies. An imaginative approach to this question, coupled with experiment and research, may yet provide the answer.

The knowledge and influence of Seurat's and Signac's



6. Vincent van Gogh, *Orchard Surrounded by Cypresses*, 1888. Otterlo, Rijksmuseum Kröller-Müller.

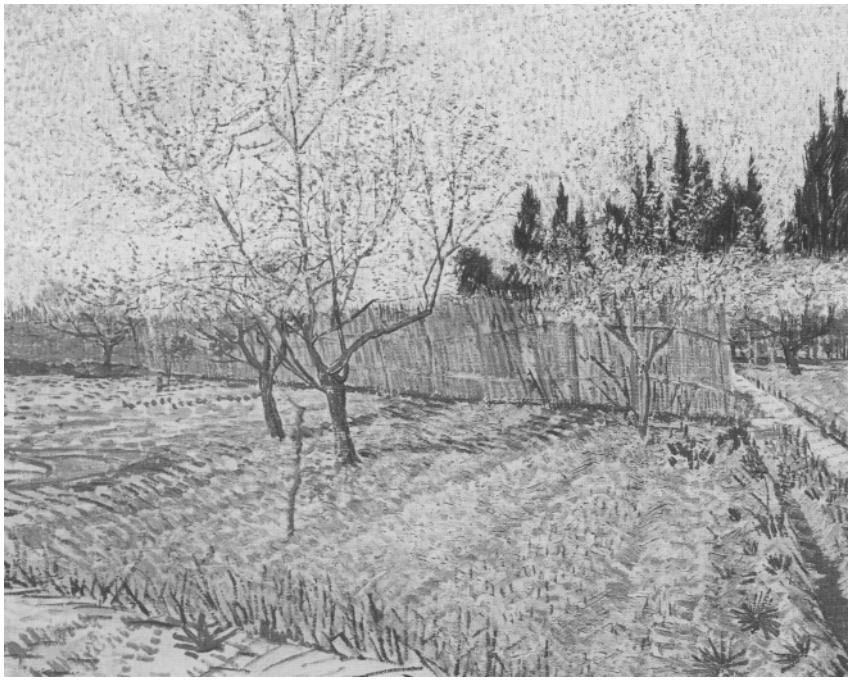
sophisticated ideas of colour division on Vincent are manifest here in the specific appearance of light and its optical vibration on the canvas.[44] White played a dominant role in expressing light in a painting, especially in the Neo-Impressionist palette. In between the row of pure colours and white was a row of colours mixed with white to create all the intervening hues, as Seurat's palette demonstrates.[45] Although Vincent later distanced himself from the divisionistic principles of the Neo-Impressionists, nearly all of his colours in the orchards in blossom were still mixed with either zinc white, lead white or both, as scientific investigation has shown. It is interesting to note that Jean Renoir remembered his father saying that it was in the south that he discovered the value of white.[46]

The pale chalky effect of white hues which now dominates the *Peach Trees* is created by the thick layers of paint. Vincent discovered empirically what W.J. Muckley had written in 1880 about impasto in oil painting. 'When painting with white or with light tints, it will be found that the greatest power of reflecting light is obtained where the colour has been laid on the thickest. White, or tints of the description alluded to, employed thinly, are not nearly as powerful as when laid on with great body. The part of the work which is intended to be the brightest and most powerful should therefore receive the greatest body of colour, and sometimes be loaded with it.'[47] White as a pictorial element was not only represented in the colour mixtures themselves but also through the white primed canvases, which gives the colour a much brighter appearance than the traditional toned ground.

THE COLOUR CONCEPT AND DISCOLOURATIONS

'In spring – say February or even sooner I may be going to the South of France, the land of the blue tones and gay colours' [459a]. Vincent wrote this in Paris eighteen months before he went to the south. After telling his sister Wil that one of the orchard paintings that he had finished that same day in April was intended for Jet Mauve, the widow of his teacher, he repeatedly explained the colourful new palette to her: 'sky blue, light grape red, violet' in contrast to Mauve's palette, which belonged to the north,[48] Mauve himself being described as 'a master of the gray' [w3]. 'Besides, what they want in pictures nowadays is a contrast of colour, and these colors highly intensified and variegated, rather than subdued gray tones' [w2]. Referring to Impressionism in these letters, he also talked about the theory and laws of colour, complementary contrasts and the exaggeration of colour.

When Vincent was still in Holland he had characterised each season with a pair of complementary colours: spring was red and green, summer blue and orange, autumn yellow and violet, and winter white and black.[49] Now, in the



7. Vincent van Gogh, *Orchard with Peach Trees in Blossom*, 1888. Private collection.

Provençal spring, he used all the complementary pairs at once,[50] as if the flowering trees of springtime embodied the life of all the seasons. This approach to colour – combining the empirical and the theoretical – becomes clearer after an investigation of the painting technique of the orchards in blossom. One of the results is an awareness of the optical changes of some pigments, which helps us understand not only a certain logic in the use of colour, but also enables us to acknowledge the truth of the colour descriptions in Vincent's letters.

The discolourations, for example, severely impair the colour balance of the original compositional concept. The apparently overemphasised dark lines accentuate the element of drawing, which was not intended to be so marked. Furthermore, the loss of contrasts and shadows causes a levelling of perspective and space. If we examine each painting in detail we can imagine what it looked like before the discolourations took place.

The Pink Orchard

This, the right wing of the triptych, is the only one of the three pictures not to have painted shadows. The light must have come from behind the artist, casting the shadows behind the trees. Only the blossoms reflect the bright light. Although a few dots had a stronger 'apricot' colour (the red and yellow lakes of the mixture with white have faded), the different tints of the blossoms are still visible. Their application spread in various directions making them almost appear to move in the silent, static air. This effect is increased by the alterations of the now faded ground, which was once pale pink, to which the painting owes its title. Many branches and contours of the tree trunks were drawn in a dark carmine, which was laid on thinly and has almost completely faded. Where it was applied pure and thick it has faded on the surface layer only, turning slightly brownish and showing severe cracking due to its medium of egg yolk (fig. VII, p. 51).[51] In addition, the sketchy blue lines have become vague, their contrast diminished to soft transitions between the branches and the discoloured ground. Not only has the pale pink faded throughout, giving the ground a greyish tone, but due to the thin priming the alterated brownish canvas shows through the deteriorated, semi-transparent and cracked ground. Even worse is the fact that wax from a former conservation treatment has penetrated through the top part of the canvas (fig. VIII, p. 51). As a result of the build-up of the painting – with parts of the main shapes being painted on the ground before the sky was added around them, the ground and canvas were sometimes left visible, and in those areas the wax extrusion appears dark brown.

The tonality of the ground in the lower part of the picture has also been distorted by a former treatment, where in the interests of consolidation a synthetic glue (PVA) was used.[52] This alterated adhesive has also soaked through to the front of the picture at various places, even covering the paint and giving it an opaque, greyish look.

The light and airy upper part of the canvas contrasts with the very green grass at the bottom, which is structured by its complementary red, both colours being applied in vertical, hatched brushstrokes. Here and there they are smoothed with a brownish orange-yellow which might have corresponded to the 'apricot' blossoms and would have been complemented again by a darker green.

Despite the discolourations, *The Pink Orchard* still emits a magical light deriving from the white, pink and dominant blue tones of the trees. The magical effect might also derive from the grainy, almost pastel-like look of the paint. Could this have been the same experience described by Monet in March 1884: 'What I bring back from here will be sweetness itself, white, pink and blue, all enveloped in this magical air'. And to Durand-Ruel: 'It may well make the enemies of blue and pink complain since it is precisely that brilliance, that magical light that I am trying to render'.[53]

Vincent very probably knew of these enemies, for the mystical bluish-violet tints of the Impressionists had caused quite some confusion among the art critics of the 1870s. Some thought that the artist's retina could perceive ultraviolet light, while others regarded it as a mark of insanity. The science of optics was also invoked in an attempt to find a natural explanation: 'The violet visions were an involuntary sequential phenomenon, the negative after-image of yellow, for every sensitive eye out in the sunlight'.[54]

The White Orchard

Vincent described this painting as follows: 'This morning I worked on an orchard of plum trees in bloom; all at once a fierce wind sprang up, an effect I had never seen before, and returned at intervals. The sun shone in between, and all the little white flowers sparkled' [476]. And indeed, there is a strong diagonal movement in the branches from the left to the right. The marked outlines of the 'thousands of black branches' [474], mainly Prussian blue with some brown and a little dark red, form a regular network whose repetitious pattern echoes the elements of the reed drawing, 'sharpened the way you would a goose quill' [478] he made from the same vantage point (*fig. 8*). The letter to Bernard again

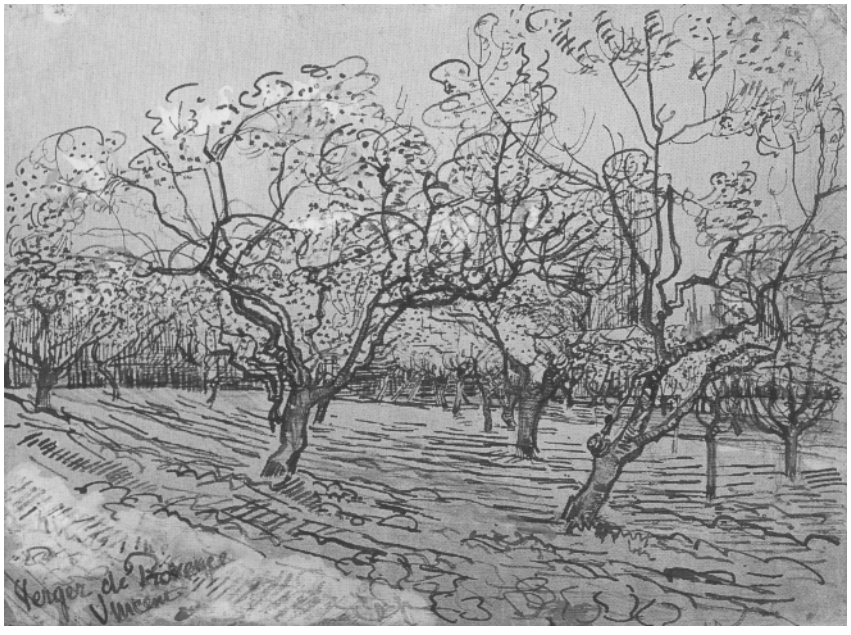
clearly explains the build-up of the painting: 'Working directly on the spot all the time, I try to grasp what is essential in the drawing – later I fill in the spaces which are bounded by contours – either expressed or not, but in any case felt – with tones which are also simplified, by which I mean that all that is going to be soil will share the same violet-like tone, that the whole sky will have a blue tint, that the green vegetation will be either green-blue or green-yellow, purposely exaggerating the yellows and blues in this case' [B3].

We find these exaggerated yellows and blues in all the little stipples and dots of the blossoms. Although Vincent talked about 'white flowers', he painted most of the blossoms yellow. He may have done so not only to let them express the yellow sunlight, but also to contrast with the blue sky. His preference for these two complementaries may derive from his admiration of Delacroix, as he commented in his paint order of April 1888: 'They [the colours] are only to be found in Delacroix, who had a passion for the two colours which are most condemned, and with most reason, citron-yellow and Prussian blue. All the same, I think he did superb things with them, the blues and the citron-yellows' [476]. Some of the yellow spots have turned a muddy brown,[55] but originally these blossoms were probably a light greenish yellow.[56] Some of the white blossoms, especially on the little tree in the foreground, were once pink. Vincent talks about the violet tone of the soil, a colour indication that also appears on the drawing of the triptych: 'terrain violet et vert' [476]. The violet in the shadows of the trees in the ploughed field was indeed laid in as a complementary contrast to the yellow blossoms. Here Vincent was following the Impressionist principle of coloured shadows, which he had already read about in Charles Blanc, who wrote 'that the shadow is always slightly tinged with the complement of the color'.[57]

The violet was most probably a mixture of white, blue and red lake. Unfortunately the purple component has faded away completely, leaving only the turquoise blue. The lines and brushwork are in balance in this painting, but the original complementary colour contrast has been disrupted by discolourations, so that greenish hues now predominate. The signature in the green field is also done in the complementary red, but is less aggressive than in *The Pink Orchard*.[58]

Peach Trees in Blossom

There are some striking differences between this painting and its lateral wings in the triptych, and also with its predecessor, *Souvenir de Mauve*. While the others were a rapid and direct, almost intuitive reaction to the nature in front of Vincent, *Peach Trees in Blossom* is a studio work in which he struggled with the paint in order to create a similar effect. It is possible that the first layer of paint was closer in colour to the *Souvenir de Mauve* than the final result, and that it also had more similarities with the watercolour sketch (fig. IV b, p. 50; *fig. 9*). The field was roughly and thinly laid-in with



8. Vincent van Gogh, *Orchard in Blossom*, 1888. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

pink and mauve, with varying proportions of red and blue mixed with some orange. This pink layer is only visible along the edges and in transitional areas between the tree, the sky and the fence area. On top of that layer Vincent continued with thicker paint, which finally covered the ground completely and formed dense clusters of peaked impasto, with which he almost modelled the blossoms. The latter were originally bright pink, with some yellow, red and white accents here and there. The field is covered with many hatched and stippled colours next to and on top of each other. It seems as if Vincent went on working until the tree area became so dense that it had to be broken with some light blue patches to suggest the sky glimpsed through the branches. The fence area was made less compact with bright blue brushstrokes. This revising and reworking in search of the right effect made the space in the painting less clearly defined. The extent of the discolouration can be seen along the lower edges of the field, where the original colour has been protected from the light by the rabbet of the frame.[59] The present general impression of greenish white-yellow in the field was probably originally dark orange-pink. The blue shadows were purple and violet, which means that Vincent had used the law of complementary colour contrasts by adding accents of some yellow and bright orange brushstrokes. Some of the little greyish-red dots in the earth are cracked, revealing a bright orange-red, which has faded on the surface, where the dots now appear dull and opaque (fig. IX, p. 52).[60]

Other larger strokes of a brownish white to the right and below the tree were originally more orange-pink.[61] The grey-brown colour in the foreground and to the left of the main tree consists of chrome yellow that has turned brown.[62] The tree, too, is heavily discoloured: the thick outline on the left side of the trunk was orange red (eosine), and in addition to Prussian blue the shapes of the branches had some dark red accents (probably carmine). The main colour of the blossoms, now white, was strong pink and crimson red: 'against a scintillating blue sky with white clouds, and in the sunshine' [W3] (fig. X, p. 52).[63] Some blossoms originally appeared a brighter yellow.[64]

These discolourations have had a major impact on the colour composition envisaged by Van Gogh. The most abundant and important hue, the purple-pink, has faded completely in the blossoms and in the field (figs. XI, p. 52). 'In consequence of the richness and beauty of these lakes, painters are ever indulging in their use [...]. In oil painting, when Crimson lake is used alone, as a thickish glaze, and kept from strong light, it will not rapidly change. But if combined with white lead, its colour goes immediately', as

9. Vincent van Gogh, *Pink Peach Trees*, 1888. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

Muckley wrote.[65] Vincent suspected this, writing: 'All the colors that the Impressionists have brought into fashion are unstable, so there is all the more reason not to be afraid to lay them on too crudely – time will tone them down only too much' [476]. Unfortunately Vincent still underestimated the fading of the red lakes,[66] which is almost tragic when we consider the great importance he attached to this colour. In the pink peach trees nothing is left of the complementary contrasts, which together with the stippled dots illustrated the Neo-Impressionist laws of colour – the yellow-orange of the sunlight, reflected in the field and opposed to the neighboring luminous blue-violet light in the shaded areas.

The fence area, with its bright, obviously stable colours, cuts into the composition as a sharp triangle. Its orange-red was originally balanced with strong purples, pinks, violets and other bright orange-red lines sprinkled over the field.

The perspective created by warm colours, which appear to come forward, and cool colours, which appear to recede, is destroyed. The dark lines of the branches appear overemphatic in their drawing. The apparent greyish-white hue of the blossoms is hard to distinguish from the clouds, and the depth of the field is gone. Both almost create the impression of a snowy winter landscape. We can assume that this copied version was possibly even more colourful than the *Souvenir de Mauve* which is quite well preserved.[67]

CONCLUSION

If we try to imagine the colour programme of the three individual paintings as it probably was originally, we can see that the tonal modelling of local colours was subordinated to the enhancing effect of the colour scheme. Vincent was attempting to create harmony both by intensifying the colours themselves, and by arranging them in their complementary contrasts. He applied that principle not only by using it in the composition of one painting, structuring the planes and details, but also in his choice of pictures for the triptych. The vertical, powerful centrepiece, with its dominant purple-pink and some orange-red values throughout, was balanced by the green fields of the horizontal wings. The blossoming trees were set almost next to each other as simultaneous contrasts: the soft orange and 'rose pâle' of the apricot trees on the left, the bright pink with powerfull orange of the peach trees in the middle, and the strong yellows of the plum trees on the right.

'Knowing' about the discolourations and describing them in words cannot of course substitute for the emotional impact which the original colours of the paintings would have had. To a certain extent this must be left to the viewer's imagination. Any reconstruction, though, is bound to be speculative. Our knowledge of the discolourations not only gives us a better understanding of Vincent's concept of colour and development, but also proves that the colour descriptions and annotations in the letters and drawings are correct. It may also help us re-evaluate the harmonies of his paintings. It is to be hoped that these flowering orchards still create the effect that Vincent intended, for he was convinced that 'this subject delights everybody' [475]. Colour, which expressed his feelings of gaiety, the overwhelming sensation that the Provençal spring gave him.

NOTES

Carol Stringari's untiring dedication and her professional coöperation contributed greatly to the success of the project in the limited time available. They also provided the foundation for a lasting friendship.

I would particulary like to thank my colleague Louis van Tilborgh to whose critical eye I owe the form of this and the following essay. Our discussions generated stimulating ideas on Van Goghs working method.

1. The repetition of one motif began with De Nittis's series *D'impressions du Vésuve*, followed by Degas and Monet. Other artists like Cézanne, Sisley, Guillaumin and Pissarro repeatedly painted series of favourite locations. See S. Monneret, *L'impressionisme et son epoch. Dictionnaire international illustré*, vol. 3, Paris 1980, p. 256.

2. Quoted from J. House, *Nature into Art*, New Haven & London 1986, p. 150.

3. See E. van Uitert, *Vincent van Gogh in Creative Competition. Four Essays from Simiolus*, Zutphen 1983, p. 31.

4. The proposed configuration of the two other triptychs is not entirely clear. *Pear Tree in Blossom* (F 405) was probably to have been flanked by *Plum Trees in Blossom* (F 553) and *Apricot Trees in Blossom* (F 556). All that is known of the third suite is the outer wings: *Orchard Surrounded by Cypresses* (F 513) and *Orchard with Peach Trees in Blossom* (F 551). See E. van Uitert *et al.*, exhib. cat. *Vincent van Gogh. Paintings*, Amsterdam (Rijksmuseum Vincent van Gogh) 1990, cat. nos. 37-38, 41-43; J. Hulsker, *Van Gogh door Van Gogh. De brieven als commentaar op zijn werk*, Amsterdam 1973, pp. 121-25; and R. Pickvance, exhib. cat. *Van Gogh in Arles*, New York (Metropolitan Museum of Art) 1984, pp. 45-53.

5. See also ibid., cat. nos. 37-38.

6. See letters 465, 466, 468, 470, 471, 472, 473, 474, 476, 479, 480, 482, 483, W3, W4.

7. See the contribution by H. Travers Newton, and T. Reff, 'The Technical Aspects of Degas's Art', *Metropolitan Museum Journal* 4 (1971), pp. 141-66.

8. The measurements of the two paintings indicate the use of the standard landscape size 25 (81 x 59-62 cm) as specified in the Lefranc & Cie table of 1885. Tables with standard sizes are reproduced in B. Haaf, 'Industriell vorgrundierte Malleinen: Beiträge zur Entwicklungs-, Handels- und Materialgeschichte', *Zeitschrift für Kunsttechnologie und Konservierung* 1 (1987), no. 2, pp. 12-16, and in A. Callen, *Techniques of the Impressionists*, London 1988, p. 59. Slight discrepancies in dimensions can be due to the fact that, after they were treated, canvases were mounted on new stretchers instead of the original ones.

9. Interestingly, in 1757 Pernety was already dealing in standard sizes (measured not in cm but old Parisian feet), whose numbers derived from their prices. It seems that the numbers were then retained as specifications, even when the prices changed. In Lefranc & Cie's tables of 1855, 1883 and 1890, the longest side was invariable and was listed in the second column, next to the size number. The measurements of the shorter side varied – depending on whether the canvas was to be used horizontally or vertically, which was dictated by the subject. For the literature see note 8.

10. Samples of variously coloured grounds are reproduced in Haaf, op. cit. (note 8), p. 50, and Callen, op. cit. (note 8), p. 61.

11. Haaf, op. cit. (note 8), p. 36, and E. Bosshard and B. Mühlethaler, 'Bindemittel in der Staffeleimalerei des 19. Jahrhunderts. Eine tabellarische Übersicht aus Zeitgenössischen Quellen', *Zeitschrift für Kunsttechnologie und Konservierung* 3 (1989), no. 1, pp. 41-101.

12. B.L. Engel, *A Study of the Materials and Techniques Used by Vincent van Gogh*, unpublished manuscript, Intermuseum Laboratory, Oberlin 1975, pp. 3, 5.

13. Callen, op. cit. (note 8), p. 60.

14. Monneret, op. cit. (note 1), pp. 291, 294.

15. According to Lefranc & Cie, size 30 measured approximately 92 x 70-73 cm; see Haaf, op. cit. (note 8), p. 33.

16. Theo first his brother some samples, see letter 477.

17. On matte effects see the contributions by H. Travers Newton, and Cornelia Peres, 'On Egg-White Coatings'.

18. Pipe clay or china clay is kaolin, 'natural hydrated silicate of aluminium (AL_2O_3, $2SiO_2$, $2H_2O$)'; see R.J. Gettens and G.L. Stout, *Painting Materials*, New York 1966, p. 105. It is a semi-transparent, finely divided homogeneous clay, appropriate for very smooth grounds, which is why it is also used as a white bole for gilding. See K. Wehlte, *Werkstoffe und Techniken der Malerei*, Stuttgart 1985, pp. 60, 78.

19. Another picture which may have been painted on that pink primed canvas is *Apricot Trees in Blossom* (F 556), which is almost identical in size to *Plum Trees in Blossom* (F 553), its probable partner flanking the centrepiece in one of the other triptychs.

20. The size for marine or landscape paintings had different dimensions: no. 15 (65 x 45.9 or 48.5 cm), no. 25 (81 x 59 or 62.1 cm). See Haaf, op. cit. (note 8), p. 33.

21. I would like to thank Michael Clark and John Dick, curator and painting conservator at the National Gallery of Scotland respectively, for their kind help and useful information.

22. See the contribution by Carol Stringari, p. 66 and note 34.

23. The medium of a normal ground is animal glue, sometimes with oil added. One of the very few recipes given in painters' manuals can be found in J.N. Paillot de Montabert, *Traité complet de la peinture*, 9 vols., Paris 1829-51, where either egg yolk or egg white is mixed with eggshell, wheat bran and pigments; see the table in Bosshard and Mühlethaler, op. cit. (note 11), p. 52. Bran has a high gluten content, and so might have been added for its binding properties.

24. See the table of pigment analysis from *The Pink Orchard* on p. 81-84. Egg yolk was clearly identified using the FTIR method by M.F.S. Karreman, CL, Amsterdam. Eugena Ordonez, scientist at the Museum of Modern Art, New York, obtained very useful information with additional analytical research techniques using SEM backscatter images.

25. The impasto is too thick to be penetrated by infrared reflectography.

26. He did not follow up this idea consistently, for charcoal underdrawings are found in later paintings, such as the 1889 copies after Millet's *Les travaux des champs*.

27. He used a frame when he was struggling to master perspective in his early years as a painter in The Hague in 1882. There are several drawings of it in his first sketchbook, reproduced in J. van der Wolk, *The Seven Sketchbooks of Vincent van Gogh*, New York 1986, figs. 56, 59, 81, 82, 85.

28. *Peach Trees in Blossom* has a bright red line broken off by the fence, *The Pink Orchard* an ochre brushstroke untidily covering a thin, dark blue line from the sketched composition, while *The White Orchard* has a brown horizon line, later enhanced with dark red.

29. Callen, op. cit. (note 8), p. 105. Due to the Newtonian laws of optics, black and white are lacking in the visible light spectrum and, consequently, in the chromatic circles reproduced in many treatises on colour theories, such as C. Blanc, *Grammaire des arts du dessin, architecture, sculpture, peinture*, Paris 1867, which Van Gogh used. The quotations in this essay are from the English version, *The Grammar of Painting and Engraving*, trans. K. Doggett, New York & Cambridge (Mass.) 1874. Artists, incidentally, made their own chromatic circles. See Callen, op. cit. (note 8), p. 109; R.F. Brown, 'Impressionist Technique: Pissarro's Optical Mixture', *Magazine of Art*, January 1950, pp. 12-15, and C. Boyle-Turner, *Paul Sérusier. La technique. L'oeuvre peint*, Zürich 1988, p. 150.

30. House, op. cit. (note 2), p. 115.

31. Ibid., p. 125. Some artists reverted to the use of black later in their careers. See B. Dunstan, *Painting Methods of the Impressionists*, New York 1976, pp. 44, 65, 69. The use of black and white was not new for Vincent, since he had spoken of it earlier in Holland, when he was pre-occupied with Delacroix's colour theories as related in Blanc, op. cit. (note 29), p. 603, where one finds the comment: 'D'autres fois, ce prodigieux coloriste emploie le blanc pour corriger ce qu'aurait de brutal la contiguité de deux couleurs franches, tels que le rouge et le bleu' ('At other times this powerful colorist uses white to correct the contiguity of two colours like red and blue'; Blanc, *Grammar*, cit. (note 29), p. 160). Vincent returned to this point in June 1888 in a letter to Émile Bernard: 'Suffice it to say that black and white are also colours, for in many cases they can be looked upon as colour, for their simultaneous contrast is as striking as that of green and red for instance' [B6]. See also K. Badt, *Die Farbenlehre Van Goghs*, Cologne 1981, pp. 27, 86.

32. See also letters 463, 469, 474, 500, B2, B6.

33. Some muddy-toned brushstrokes seem to have been applied at the very end in all three paintings. These spots appear greenish under ultraviolet fluorescence, which indicates a mixture of yellow with zinc white.

34. Letters 527, 541. The subject of impasto was later to feature in the disagreement between Van Gogh and Gauguin, see the contribution by H. Travers Newton.

35. Van Gogh later rejected the 'pointillé' effect, interestingly enough in the same year that Pissarro too began to find the pointillist method too restricting. See Dunstan, op. cit. (note 31), p. 70.

36. Among them Sisley, Berthe Morisot, Pissarro and Gauillaumin, see O. Reutersvärd, 'The Accentuated Brushstroke of the Impressionists. The Debate Concerning Decomposition in Impressionism', *The Journal of Aesthetics and Art Criticism*, March 1952, pp. 106-11.

37. M. Arnold, *Duktus und Bildform bei Vincent van Gogh* (diss.), Heidelberg 1973, p. 63.

38. Especially the Cypresses (F 613), see M. Pease, 'Van Gogh. The Hand and the Brush', *Art News Annual* 19 (1950), p. 49.

39. Letters 475, 503. K. Temme, 'Industrielle Malsysteme des 19. Jahrhunderts', in H. Althöfer (ed.), *Das 19. Jahrhundert und die Restaurierung*, Munich 1987, p. 233, and R. Grimm, 'Material und Technik der Haager Malerschule', in idem, pp. 217-20. Being suspicious of the quality of new paint products, Renoir might have

been one of the very few who continued to have his colours ground by hand in Mullard's workshop; Dunstan, op. cit. (note 31), p. 65.

40. Letters 472, 476, B3, B4.

41. Wax in zinc oxide is used to improve flexibility and correct the natural tendency to form pastes of a stringy consistency. Wax in Prussian blue, cobalt green and cobalt yellow helps overcome the granular texture, and is added to chrome oxide and vermilion (heavy pigments) to minimise the settling or separation of pigment and oil. See R. Mayer, *The Artist's Handbook of Materials and Techniques*, London 1972, p. 152.

42. Ibid., p. 146.

43. See the contribution by Cornelia Peres, 'On Egg-White Coatings'.

44. See Callen, op. cit. (note 8), p. 158.

45. W.I. Homer, 'Notes on Seurat's Palette', *The Burlington Magazine* 101 (1959), pp. 192-93, and E.W. Lee, 'Het Neo-Impressionisme', in exhib. cat. *Neo-Impressionisme. Van Seurat tot Struycken*, Amsterdam (Rijksmuseum Vincent van Gogh) 1988, p. 17.

46. House, op. cit. (note 2), p. 125. Unlike Pissarro, who wrote: 'I eliminated from my palette the intermediary whites, which gave me trouble. I left only one white at the beginning and one at the end of the row of colour on my palette. [...] Thus I am completely liberated from Neo-Impressionism'; quoted in Dunstan, op. cit. (note 31), p. 74. Monet reacted similarly; see House, op. cit. (note 2), p. 75.

47. W.J. Muckley, *A Handbook for Painters and Art Students on the Character and Use of Colours* [...], London 1880, p. 84.

48. He said the same to Theo: 'So, of all the colours I ordered, [...] hardly one of them is to be found on the Dutch palette, in Maris, Mauve or Israëls' [476]. See also letters 481 and 477a.

49. E. van Uitert, 'De toon van Vincent van Gogh: opvattingen over kleur in zijn Hollandse periode', *Simiolus* 1 (1966-67), p. 110.

50. J.A. Walker, *Van Gogh Studies. Five Critical Essays*, London 1981, pp. 7-20, notes certain inconsistencies in Vincent's naming of the complementaries in his letters, in particular that he confused the blue-yellow and violet-orange. He attributes this mistake to the fact that Vincent was not interested in absolute precision and did not believe exactitude to be any guarantee of good art. He may well be right, given the limited vocabulary Vincent used to describe complementary pairs, but in Van Gogh's paintings as they originally appeared the complementaries were logical. Especially if we imagine subdivided tints with their opposing colour we would see more differences in degree, such as those listed in T.H. Fielding, *On the Theory of Painting; to which is Added an Introduction to Painting in Watercolours*, London 1823, p. 45, where the colour nuances are arranged in contrasting pairs.

51. This analysis was done by F.S.M. Karreman, CL, Amsterdam. We have no explanation as to why a tempera medium was used here, and cannot say whether it came from a tube colour or not. Vincent never mentioned mixing pigment with egg yolk himself. The only indication we have is that he complained about the differing qualities of the reds when ordering paint through Theo.

52. See the contribution by Carol Stringari.

53. Quoted from House, op. cit. (note 2), pp. 123-24.

54. See O. Reutersvärd, 'The "Violettomania" of the Impressionists', *The Journal of Aesthetics and Art Criticism*, December 1950, pp. 106-11. The author explains how misleading this explanation is. Although yellow does indeed give a violet after-image, sunlight is white with a black or grey after-image. It is interesting to note that the chemist Church observed that cobalt blue has a characteristic purplish hue when seen in candle or gas light; A.H. Church, *The Chemistry of Paints and Painting*, London 1901, p. 212.

55. The mixture of colours was analysed as lead white, a few large grains of emerald green, chrome yellow and a yellow lake. The latter has faded, and the chrome yellow has turned brownish as a result of an alteration process.

56. Some of the pure yellows also appear to have a soft consistency, which is presumably due to the addition of wax to the medium.

57. Blanc, op. cit. (note 29), p. 600: '[...] que l'ombre se coloure toujours légèrement de la complementaire du clair'; the English translation is from Blanc, *Grammar*, cit. (note 29), p. 155. He based this idea on Goethe's and Chevreul's laws of colour.

58. The signature on the green grass of *The Pink Orchard* is bright red – a complementary principle of coloured signatures which according to J. Rewald, *Post-Impressionism. From Van Gogh to Gauguin*, New York 1962, p. 136, derives from an innovation by Signac.

59. See the contribution by Paolo Cadorin.

60. Sample analysis showed that it is an organic, synthetic pigment, lake of eosine. See the contribution by Judith Hofenk de Graaff *et al.*

61. Analysed as carmine and a yellow lake (a combination of the natural weld and a synthetic organic yellow).

62. See the contribution by Mette Marie Bang, and H. Kühn and M. Curran, 'Chrome Yellow and Other Chromate Pigments', in R.L. Feller (ed.), *Artists' Pigments: a Handbook of Their History and Characteristics*, Cambridge etc. 1986, pp. 187-218.

63. Again carmine mixed with chalk and lead white.

64. These are a few yellow and brownish whites containing chrome yellow and a yellow synthetic lake, also faded, mixed with chalk and lead white.

65. Muckley, op. cit. (note 47), p. 30.

66. Renoir recognised those changes in his own paintings and consequently changed his palette, although he thought it would take 50 years for his works to find their true balance; see G. Bazin, 'Introduction à la technique des peintres impressionistes', ICOM *Committee for Conservation*, 2nd Triennial Meeting, Amsterdam 1969, preprints.

67. For a proper comparison the colour scheme of the *Souvenir de Mauve* (F 394) will have to be analysed.

On Egg-White Coatings

Cornelia Peres

On top of many paintings by Vincent van Gogh there is a very noticeable greyish layer (fig. XII, p. 52) which is quite distinct from surface grime or discoloured varnish. Its insolubility and optical properties suggest that it is an egg-white coating, and this was demonstrated in all three orchard paintings by positive staining tests for protein and by additional FTIR analysis with a clear egg-white spectrum.[1]

This phenomenon has not yet been investigated on a systematic and statistical basis.[2] In only a few cases has egg-white coating been preserved – either because it was deliberately left on the paint surface, or because the artist forgot to remove it. The coating has a greyish, grimy appearance, and grows greyer with time, depending on the concentration of the egg white that was diluted in water. The darkening process is slow, taking between 20 and 50 years to complete.[3]

Why, one wonders, did Van Gogh use egg-white varnishes? Was it his own discovery, or common practice among painters of the day? The latter, I suspect. Nearly all the eighteenth and nineteenth-century painting treatises contain at least one reference to egg-white varnish, which indicates that its use was a widespread and well-known practice. Many of these manuals and treatises relied on older sources in a chain that can be traced back to the Renaissance. As early as 1400, Cennino Cennini was recommending egg white as a temporary varnish on tempera painting to isolate the paint film (surface) from the final layer of 'vernice grassa' (an oily film made of mastic diluted in turpentine).[4] The later sources all give very similar recipes for egg-white varnish, so much so that it seems that there was little change in the advice given to artists down the centuries.

It would be going beyond the scope of this article to trace the intervening steps between the Renaissance and the nineteenth-century treatises, but it is worth taking a brief look at the best-known eighteenth and nineteenth-century French sources (see Appendix on p. 44). The extent to which the various authors rely on one another is demonstrated by the letter on the use of varnish written by the English landscape painter Philip Hackert, which was published in Italian in 1788 and translated into German in 1800. It contains many notes and comments taken from old Italian sources, as well as references to Watin's *L'art de faire d'employer vernis* from 1778 and Pernety's *Dictionnaire portatif de peinture, sculpture et gravure* of 1757.[5] These books, and many others, are also encountered in the extensive bibliography in Paillot de Montabert's manual of 1829-51.[6]

RETOUCHING VARNISH

Where, though, did Van Gogh learn about the use of egg white? It was in The Hague that he embarked on his career as a painter. In December 1881 he had taken his first professional lessons from his cousin Anton Mauve, a leading representative of the Hague School. Little is known about the painting techniques of this school,[7] either through painter's manuals or scientific analysis. Our only information comes from *De praktijk van het schilderen* by Willem E. Roelofs Jr.[8] Although only written in 1919, almost four decades after the event, it can still be considered a valuable source, since the writer was the son of Willem Roelofs (1822-1897), a member of the Hague School.[9] Willem Jr. was taught by his father,[10] and was thus familiar with the traditional painting methods. In his book he also mentions Mauve, Vincent's teacher, on several occasions.

Retouching varnishes are discussed by Roelofs in his chapter on painting in oils. 'Retouching' was an artist's term for reworking on top of another paint layer, in the sense of making minor corrections. Egg white was recommended as a retouching varnish, and was used as an isolating layer to protect the underlying film of fresh oil paint, or to give the second layer a better bond to a film that had already dried.[11]

We know from his letters that Van Gogh also used egg

white in this way. In his entire correspondence with Theo he refers only twice to the application of an egg-white coating. The first time was 1883 (to be discussed below), and the second in 1885, when he had almost finished the Potato Eaters: 'I shall [...] wash it [...] with the white of an egg, and finish some details' [404].

Van Gogh evidently continued using egg white in this way in France, as shown by the three orchard pictures of 1888. He was of course a more experienced artist in Arles than he had been in Nuenen, but he still retouched his paintings frequently. He mentions that he had reworked his series of orchards in blossom once they were all finished in order to give them some balance.[12] As a result, residues of egg white are found in many interstices of the impasto. *The Peach Trees* (F 404) which is a copy after his *Souvenir de Mauve* (F 394) had given him particular trouble in his attempts to regain the effect of the original. The fact that the egg white is no longer a continuous, regular layer could be due to early washing, or to reduction during the restoration treatment in the 1930s, when a rye starch facing that had been applied to protect the paint layer was removed with water after the wax relining had been done.

TEMPORARY COATING

Another reason for applying a retouching varnish consisting of egg white (also called 'uithaalvernis' by Roelofs) was to restore a saturated appearance to the surface of the oil paint, which becomes matte and changes in colour value when painted on an absorbent ground into which the binding medium has sunk.[13] As Muckley says: 'The chief use of varnish is to bring out the full value of the darker colours'.[14] This was probably the effect that Vincent was thinking of when he mentioned the subject of varnish in connection with small oil sketch he sent from Nuenen to Paris. In a postcard which he mailed to Theo on 24 September 1883, while he was still in Holland, he wrote: 'Today I send you by parcel post three studies which I hope are dry enough; however, if they stick to the sheet of paper I put over them as a precaution, sponge them off with tepid water. The paint on the smallest one especially has sunk in a lot. In a week or so brush it over with the white of an egg, or with a little varnish in a month, to restore the colour' [327]. And in October 1885: 'The still lifes I am sending are colour studies, I intend making more of them; don't think this is useless. After a while they will get darker ['inschieten' in Dutch, a better translation would be 'become matte'], but in a year, for instance, they will be better than now, when, being dry to the core, they get a solid varnish' [426].

As we know, Vincent was very keen to send his paintings to his brother as soon as possible, without waiting until the thick impasto had dried, so he had to protect the surface before dispatch. As another artist who followed this practice explained: 'Being obliged to send the copy to Philadelphia before it was quite dry, I covered the surface with egg varnish, to prevent the action of stickiness in the paint while the canvas was rolled up'.[15]

We can assume that Vincent knew that a fresh oil painting cannot immediately be varnished with a resin dissolved in turpentine, but can only be covered with an egg-white coating, which is a proteinaceous, aqueous solution. As a nineteenth-century writer put it: 'When [a resinous] varnish is put upon oil pictures too soon after they are painted it tears up the partially dried colour, and produces fissures which are nearly always irreparable'.[16]

Most of the authors of painting treatises – Paillot de Montabert, Dossie, Burtin, Bouvier and Hackert – agreed that egg-white varnish was meant to be a temporary measure, and pointed out that it had great disadvantages. One was that it cracked,[17] and sugar was recommended as an additive to prevent this happening,[18] as well as 'to make it work more freely with a brush'.[19] Others, like Pernety, Goupil and Roelofs warned that egg-white varnish ruins a picture by setting up tensions, and that once alterated it becomes insoluble.[20] Goupil therefore recommended changing the egg white every fifteen or twenty days until the application of the final, resinous varnish, otherwise the transpiration of oil, when mixed with the egg white, would form a grime layer, which, once hardened, was extremely difficult to remove.[21] Goupil's book went through several reprintings in a short space of time, and was well known among the Parisian artists of Vincent's circle.[22] In his chapter on painting restoration he repeats that egg white, once alterated, becomes insoluble in water or 'acidic solvents',[23] and that this was due to the bad habit some artists had of varnishing with egg white without the addition of sugar or spirit. An ingredient in many recipes is 'esprit de vin', or spirits of wine, which was presumably added to facilitate reversibility.[24] This is followed by a long explanation on how to prepare a painting by washing off the egg white or grime layers with water and a sponge before applying the final resinous varnish. Willem Roelofs Jr. warns against using egg-white varnish as a temporary coating before final varnishing also because it could be forgotten or insufficiently washing off.[25]

Whether Van Gogh indeed washed his paintings is not clear. The first time that he speaks of doing so is as late as

December 1888. Gauguin was staying with him at the time, and had obviously given him this tip, though here the aim was to degrease the oily impasto and to achieve a matte surface appearance. 'I am rather sorry to have my room full of canvases, and to have nothing to send when Gauguin sends you his. It is because Gauguin has told me how to get rid of the grease in the things painted in impasto by washing from time to time. And then when that is done, I must go over them and retouch them. If I sent them to you now, the colours would be duller than they will be later. They all think what I have sent too hastily done. I do not deny it, and will make some alterations' [563].

In May 1889 he wrote: 'I think you had better wash the canvases which are quite, quite dry with water and a little spirits of wine to take away the oil and the essence in the impasto. The same goes for *The Night Café* and *The Green Vineyard*, and especially for the landscape that was in the walnut frame. Night, too, but that has been retouched recently and might run with the spirits of wine' [593].

SATURATION OF COLORS

Vincent's very few remarks on varnish (presumably resinous) varnish in his later career are again related to an enhancement of the dark colours. As already mentioned, some dark colours in particular, like Prussian blue, appear matte because they need a high oil content for saturation. That oil might soak into the absorbent ground or, due to the use of some wax extenders in early tube colours, could have needed an additional amount of medium to regain a certain intensity.[26] This might explain the remarks in Vincent's letter to the critic Albert Aurier in February 1890 on the subject of the *Cypresses* (F 620), where the application of a varnish served to enhance the chromatic effect. 'It will be a year before the study that I am going to send you will be thoroughly dry, also in the thick layers of paint; I think you will do well to lay on a goodly coat of varnish. In the meantime it will be necessary to wash it a good many times with plenty of water in order to get the oil out. The study is painted with plain Prussian blue, the much-maligned colour nevertheless used so often by Delacroix. I believe that as soon as the tones of this Prussian blue are quite dry, you will, by varnishing, get the black, the very black tones, necessary to bring out the various somber greens' [626a].

Two months later Vincent instructed his brother to apply a varnish. 'The remaining canvases do not amount to much; not having been able to work for two months I am very much behind. I think you will find that the olives with the pink sky are the best, and the mountains; the first would go well as a pendant to those with the yellow sky. As for the portrait of the Arlésienne, you know that I have promised a copy of it to our friend Gauguin, and you must send it to him. Then the cypresses are for M. Aurier. I should have liked to do them again with a little less impasto, but do not have the time. They must be given a few more washes with cold water, then a strong varnish when the impastos are thoroughly dry, then the blacks will not become dirty-looking when the oil has evaporated' [629].

This emphasis on the black tones indicates that the varnish was to be applied above all for the saturation of some specific colours. It even suggests that it was meant to be a local measure only. Neither letter specifies the kind of varnish to be used – a glossier, resinous type or a more matte proteinaceous one, but presumably it was the former.

MATTE SURFACES

A matte surface was an important consideration for many Impressionists, Neo-Impressionists and subsequent generations of painters. It was closely related to their colour theories, and to the chromatic effects of the distinctive refraction index of each pigment and medium, called *metier mat*. They often achieved this effect by soaking the oil off the tube colours onto blotting paper, and used absorbent grounds or very thinly primed canvases to paint on. In addition, the reflection of light from a visible white ground was used to achieve a 'peinture claire et colorée'. Consequently, they refused to apply any resinous or oily varnishes to their paintings, because these darken and yellow with age, creating an imbalance in the carefully selected colour harmony and interfering with the delicate ranges of light and colour reflectance with their glossy surface effects.[27] The critic Gonzague-Privat wrote in his comment on the sixth Impressionist exhibition of April and May 1881: 'Pissaro (sic) [...] showed a very curious series of landscapes, some of which [...] are absolutely remarkable. The majority [...] are framed under glass in the English style. Because of the absence of varnish, the painting is left with a matte finish. This gives it a velvety tone that has a charming effect'.[28] It is worth remembering that Pissarro had at least as much influence on Vincent as Gauguin did, and that Monet, Renoir and Degas also preferred to leave their paintings unvarnished.[29] This must have created a conflict for Vincent, whose greatest concern after 1887 was the intensity and contrast of colour.

In his frequent orders for painting materials Van Gogh

specifies the quality, size and amounts of canvas and tube colours in detail, but never asks for varnish (he could buy eggs anywhere, of course).[30] This lends further support to the supposition that Vincent did not varnish his later paintings with resin himself, but occasionally asked his brother to apply some varnish on certain colours in order to enhance their effect, when the painting had dried thoroughly. It is not known from the letters, whether Theo did so, but analysis of Vincent's later works proves only that egg-white coatings had been consistently applied at an early stage.

CONCLUSION

To sum up, the reasons for using egg-white varnishes given in painter's manuals were to isolate the paint layer before retouching, to provide a coating for paintings in transit, to equalise an irregular surface appearance, to saturate dark tones, to give the picture a temporary varnish, and to achieve a matte finish. It must have been such a common prac-tice that artists themselves rarely felt it worth mentioning. Egg-white varnishes are discussed, however briefly, in nearly all the painter's manuals of the period, but almost invariably with a note of disapproval or warning. It is not clear whether Vincent was aware of these drawbacks, or whether he knew that an egg-white varnish was meant to be temporary. Although he was virtually self-taught, and was thus particularly interested in painter's manuals, this does not mean to say that he made a thorough study of all the sources and treatises mentioned above.[31]

Among the questions that still remain is the extent to which either Vincent or his brother applied or washed off egg-white coatings or resinous varnishes. Obviously neither of them had the chance to observe the alteration of egg white by aging. Once one understands Van Gogh's intended colour composition based on contemporary colour theories it seems very unlikely that he would have accepted this greyish veil of the aged coatings that today masks the brilliance of his colours.

NOTES

An abbreviated form of this essay appeard in IIC, *Preprints of the Contributions to the Brussels Congress: Cleaning, Retouching and Coatings*, 3-7 September 1990, pp. 131-133.

1. See the contributions by Judith Hofenk de Graaff *et al.* and Carol Stringari.

2. Ninety percent of the paintings now in the Van Gogh Museum have been restored in the course of this century, and this automatically included varnishing. No notes of these earlier treatments have survived, nor are there any descriptions of the condition of the pictures at the time. Of the paintings in the major retrospective exhibition of 1990 (see E. van Uitert *et al.*, exhib. cat. *Vincent van Gogh. Paintings*, Amsterdam [Rijksmuseum Vincent van Gogh] 1990) the following catalogue numbers were unvarnished: 29 (F 359), 51 (F 430), 61 (F 428), 72 (F 487), 84 (F 517), 85 (F 611), 88 (F 719), 89 (F 615), 105 (F 659), 134 (hors de catalogue, F 822). The optical appearance of some works suggests the presence of an egg-white layer, one of the striking examples being the *Orchard with Peach Trees*, cat. no. 43 (F 551).

3. A. del Serra, 'A Conversation on Painting Techniques', *The Burlington Magazine* 127 (1985), pp. 4-16.

4. See A.P. Laurie, *The Painter's Methods and Materials*, New York 1967, p. 180.

5. P. Hackert, *Über den Gebrauch des Firniss in der Mahlerey: ein Sendschreiben des berühmten Landschaftsmahlers P. Hackert an den Ritter Hamilton. Aus dem Italiänischen frey übersetzt von F.L.R.*, Dresden 1800. See also H. Pernety, *Dictionnaire portatif de peinture, sculpture et gravure, avec un traité pratique dedifférentes manières de peindre*, 8 vols., Paris 1757; R. Dossie, *The Handmaid to the Arts*, 2 vols., London 1764; J.F. Watin, *L'Art du peintre, doreur, vernisseur*, 4th ed., Paris 1787 (ed. princ., *L'art de faire d'emploier vernis* [...], Liège 1772); P.F. Tingry, *Traité théorique et pratique sur l'art de faire et applique les vernis, sur les différents genres de peintures par impression et en décoration, ainsi que sur les couleurs simples et composées*, Geneva 1803; F.X. Burtin, *Traité théorique et pratique des connaissances qui sont nécessaire à tout amateurs de tableaux* [...], 2 vols., Brussels 1808; M.P.L. Bouvier, *Manuel des jeunes artistes et amateurs en peinture*, Paris 1827; J.N. Paillot de Montabert *Traité complet de la peinture*, 9 vols., Paris 1829-51; R. de Lasalle, *Manuel complet et simplifié de la peinture à l'huile suivi du Traité de la restoration des tableaux revu par Thénot*, Paris 1856.

See the Appendix on pp. 44-49 for the opinions of these and other authors on the use of egg white as a coating.

6. Paillot de Montabert, op. cit. (note 5), vol. 1, pp. 241-422, and vol. 9, p. 85.

7. See R. Grimm, 'Material und Technik der Haager Malerschule', in H. Althöfer (ed.), *Das 19. Jahrhundert und die Restaurierung*, Munich 1987, pp. 217-21.

8. W. Roelofs, *De praktijk van het schilderen*, Amsterdam 1919.

9. See R. de Leeuw *et al.*, exhib. cat. *De Haagse School: Hollandse meesters van de 19de eeuw*, Paris (Grand Palais), London (Royal Academy of Arts) & The Hague (Haags Gemeentemuseum) 1983, p. 267.

10. P.A. Scheen, *Lexicon Nederlands beeldende kunstenaars 1750-1950*. The Hague 1970, p. 244.

11. Roelofs, op. cit. (note 8), p. 53. See also letter 407: 'I should have liked to work on it even longer, but because of the [oil] sinking in and because I had already varnished it more than once, I felt I had to leave it alone.'

12. Letter 477: 'I am now trying every day to touch them up and give them a certain unity.'

13. Roelofs, op. cit. (note 8), pp. 55-56.

14. W.J. Muckley, *A Handbook for Painters and Art Students on the Character and Use of Colours* [...], London 1880, p. 68.

15. T. Sully, *Hints to Young Painters and the Process of Portrait Painting*, Philadelphia 1873, p. 25.

16. Muckley, op. cit. (note 14), p. 68.

17. For cracking of the paint layer see Paillot de Montabert, op. cit. (note 5), vol. 9, p. 80; Burtin, op. cit. (note 5), vol. 1, p. 51, Bouvier, op. cit. (note 5), p. 434; and Hackert, op. cit. (note 5), p. 15.

18. Burtin, op. cit. (note 5), vol. 1, p. 431.

19. Dossie, op. cit. (note 5), vol. 1, p. 226.

20. Pernety, op. cit. (note 5), ch. 98, Roelofs, op. cit. (note 8), p. 55, and [F.A.A.] Goupil-[Fesquet], *Manuel complet et simplifié de la peinture à l'huile*, Paris 1877, p. 51. Remarkably, Van Gogh's *Enclosed Field with Sheaves and Rising Moon* (F 735) in the Kröller-Müller Museum, Otterlo, has a local coating of egg yolk, mainly around the edges, which has lifted and cracked the topmost paint layer.

21. Goupil-Fesquet, op. cit. (note 20), p. 54.

22. It has not yet been determined whether this Goupil was a member of the family of art dealers for whom both Vincent and Theo van Gogh worked.

23. Goupil-Fesquet, op. cit. (note 20), p. 57.

24. Delacroix called his recipe 'Vernis à l'eau d'Ommeganck', referring to a Dutch brandy, so the recipe may have come from Holland; see A. Joubin, *Journal d'Eugène Delacroix*, vol. 3, Paris 1932, p. 132.

25. Roelofs, op. cit. (note 8), pp. 55-56. See also C. Willoughby, 'Search for Permanence: Materials and Methods of G.F. Watts (1817-1904)', in Althöfer, op. cit. (note 7), pp. 203-16: 'The need for a temporary, easily removable varnish was extremely important for many artists at that time, especially those who wished to show their work annually at the Royal Academy Exhibition.'

26. R. Mayer, *The Artist's Handbook of Materials and Techniques*, New York 1981, p. 147.

27. Roelofs, op. cit. (note 8), p. 31.

28. In *L'Evenément*, 5 April 1881; quoted in exhib. cat. *The New Painting: Impressionism 1874-1886*, San Francisco (Fine Arts Museum) & Washington (National Gallery of Art) 1986, p. 367.

29. See J. House, *Nature into Art*, New Haven & London 1986, p. 109; T. Reff, 'The Technical Aspects of Degas's Art', *Metropolitan Museum Journal* 4 (1971), pp. 141-66; G. Bazin, 'Introduction à la technique des peintres Impressionistes', ICOM Committee for Conservation, 2nd Triennial Meeting, Amsterdam 1969, preprints, p. 5. See further the contribution by H. Travers Newton.

30. In the German translation of the letters, Vincent van Gogh, *Sämtliche Briefe*, Berlin 1965, letter 475, '12 Laque ordinaire, petit tubes' is misleadingly translated as '12 Firnis, kleine Tuben'. Van Gogh was actually asking for a red pigment (organic lake).

31. The books that he mentions in his letters are listed in F. Pabst and E. van Uitert, 'A Literary Life, with a List of Books and Periodicals Read by Van Gogh', in E. van Uitert and M. Hoyle (eds.), *The Rijksmuseum Vincent van Gogh*, Amsterdam 1987, pp. 75-84.

Appendix

We are grateful to the staff of the Schweizer Institut für Kunstwissenschaft, Zürich, and to Dr Ullrich Schiessl of Bern, for supplying some of the original texts printed below. Louise Weinberg generously assisted with the interpretation of the French texts.

H. Pernety, *Dictionnaire portatif de peinture, sculpture et gravure, avec un traité pratique des différentes manières de peindre*, Paris 1757

chap. XCXVIII

Lorsqu'un tableau est embu, on y passe un blanc d'oeuf battu, au lieu du vernis que quelques un y mettent, après qu'il est achevé & bien sec. Le térebenthine qui fait la base des vernis, pénétre dans le couleur & l'altere souvent, à moins que le tableau ne soit très-vieux.

R. Dossie, *The Handmaid to the Arts*, 2 vols., London 1764

chap. VII
Of the methods of varnishing and preserving pictures and paintings.

(p. 224)
The method of preserving paintings in oil, is, by coating them with some transparent and hard substance, as a varnish, to secure the colours from the injuries of the air or moisture, and to defend the surface from scratches or any damages the painting might receive from slight violences. (p. 225) The substances that have been, or may be used for this purpose, are gum Arabic, glair or whites of eggs, isinglass size, and varnishes formed of gum resins, dissolved in spirit of wine, or oil of turpentine; which last, where oil of turpentine is used, are called oil varnishes. [...]
(p. 226)
Glair of eggs, beat to an unctuous consistence, and spread with a proper brush over the paintings, answers much the same end as gum Arabic; but has the like advantages with much less of the bad quality of cracking; for which reason it is generally preferred to that gum. It has, nevertheless, one great defect, which is its not lasting, for it requires to be renewed frequently,as either moisture or great dryness of the air injure it. It is usual to mix a little brandy or spirit of wine with the glair of the eggs, in order to make it work more freely with a brush; as also a lump of sugar to give it more body, and prevent its craking; from which, after all, it will not be entirely free, after it has some time laid on, if the picture be put into a very dry place.

Section II
Of cleaning pictures and paintings

(p. 237)
The first, and most general substance used for cleaning pictures, is water. This will remove many kinds of glutinous bodies, and foulness arising from them; such as sugar, honey, glue, and many others; and also take off (p. 238) any varnish of gum Arabic, glair of eggs, or isinglass, and is therefore the greatest instrument in this work. It may be used without any caution with regard to the colours; as it will not in the least affect the oil which holds them together. [...]
(p. 240)
Whenever paintings are varnished with gum Arabic, glair of eggs, or isinglass, the varnish should be taken off when they are to be cleaned. This may be easily distinguished by wetting any part of the painting, which will feel clammy if varnished with any substance dissolvable in water. In such cases, the taking off the varnish will frequently alone render the painting entirely clean; for if it have been laid on thick, and covered the surface every where, the foulness must necessarily lie upon it. The manner of taking off this kind of varnish must be done by means of hot water and a spunge, the picture or painting being laid horizontally. The water may be near boiling hot, and may be used copiously at first with the spunge; but when the varnish appears to be softened, and the painting more naked, it should be used cooler. If the varnish adhere so as not to be easily brought off by a spunge, a gentle rubbing with a linen cloth may be used, the cloth being frequently wrung and wet again with fresh water a little warmish.

J.F.Watin, *L'Art du peintre, doreur, vernisseur*, 4th ed., Paris 1787

(p. 122)
Lorsqu'un tableau est neuf, si vous voulez donner de la fraîcheur & de la vivacité aux couleurs, faites fondre gros comme une aveline de sucre candi dans un demi-poisson d'eau-de-vie. Battez bien un blanc d'oeuf, & introduisez-y petit-à-petit l'eau-de-vie; battez-le tout ensemble, & avec une éponge très-douce & très-fine, dans laquelle il n'y aura aucuns graviers, & qui en sera imbibée, passez dessus le tableau légérement; c'est ce que les Peintres emploient ordinairement: on l'a nommé assez mal-à-propos vernis.

P. Hackert, *Über den Gebrauch des Firniss in der Mahlerey : ein Sendschreiben des berühmten Landschaftsmahlers P. Hackert an den Ritter Hamilton. Aus dem Italiänischen frey übersetzt von F.L.R.*, Dresden 1800.

(p. 14)
Der Firnis nun, der aus einem harzigen und durchsichtigen (p. 15) Leim besteht, belebt nicht allein die von der Zeit getrockneten Farben, dringt in die Poros des Gemäldes ein. Sondern verbindet auch wieder die aufgetragenen und von der Luft abgelössten Farben mit dem Grunde. Durch dieses Mittel werden die alten Gemählde von ihrem völligen Untergange gerettet. Von allen diesem erfolgt das Gegentheil, wenn man sich des geschlagenen Eyweisses bedient: dies leztere trocknet zu schnell, so dass dadurch das allmählige Ausdünsten der Farben unterdrückt wird, und am Ende sich die Malerey abschält. Wenn der Grund gut getrocknet ist, so erhebt es zwar auf einige Zeit die Gegenstände des Gemähldes, allein bald nachher wirft es Runzeln, und überstreicht man die Malerey zu mehrern malen, so entstehen Ungleichheiten, Höcker, das Gemählde wirft sich und geht endlich

wenn ein Gemählde wiederholendlich damit bestrichen wird, dasselbe endlich seine Urzüge (antica) verliert, denn das Eyweiss verdickt sich und verwandelt sich endlich in einen so dicken Leim, dass einfaches Wasser nicht mehr hinreicht, um es von den Gemälden abzuwaschen. Hiervon kann man sich am bessten überzeugen, wenn man das Eyweiss in einem porzellanen Gefäss stehen lässt: bald wird es sich in einen festen Leim verwandeln, sich in Stücken trennen und am Ende völlig von dem Gefässe ablösen. Eine gleiche Wirkung wird es bey einer Malerey haben, nur noch mit dem Nachteile, dass es hier zugleich beym Absprin-gen die Farben des Gemählde mit hinweg nehmen wird. Die Gegner des Firnisses behaupten zwar, dass der Glanz, den die Gemählde durch den Firnis erhielten, den Beobachter zwänge, sie von einem gewissen Standpunkte aus zu sehen, um ihre Wirkung beurtheilen zu können; hierauf aber lässt sich leicht entgegnen, wie nicht allein die gefirnissten, sondern auch die ungefirnissten Gemälde, die Malereyen in fresco und in Wasserfarben, ja sogar die Zeichnungen, einen gewissen Standpunkt erfordern, um gehörigen Effect zu thun. Allein sollte demohngeachtet jemanden der Glanz, den der Firnis dem Gemälde mittheilt, missfallen, so giebt es ja geschickte Restauratoren, welche die Kunst ihn zu schwächen besitzen. Noch bleibt zu erinnern übrig, dass wenn auf alten gefirnissten Gemälden Schmutz, Staub, oder Fliegenun-reinigkeiten sich gesetzt haben, eine Wäsche von reinem Wasser hinreichend ist, allen Unrath wegzunehmen.

P.F. Tingry, *Traité théorique et pratique sur l'art de faire et applique les vernis, sur les différents genres de peintures par impression et en décoration, ainsi que sur les couleurs simples et composées*, Geneva 1803

(p. 132)
Il arrive quelquefois lorsqu'on travaille sur des impressions trop fraîches, ou sur des ébauches trop récentes, que la peinture s'imbibe et qu'elle prend un aspect gris, qui voile le véritable ton des couleurs. Un blanc d'oeuf, battu avec quelques gouttes d'alcohol (esprit de vin), appliqué ensuite avec une éponge propre et sèche, leur rend leur première vivacité: mais dans tous les cas, sans excepter même ceux qui exigent de la célérité dans l'exécu-tion du tableau, l'Artiste, jaloux de la durée de son ouvrage, se garde bien d'appliquer le vernis avant que les couleurs soient sechées à fond sous le blanc d'oeuf, ce qui n'arrive guères qu'au bout d'une année. Après cet intervalle, la même éponge qui a servi à étendre le blanc d'oeuf, rend le même office pour l'enlever, à l'aide d'un peu d'eau, sous la forme d'une écume jaunâtre. Tant que les légères frictions faites (p. 133) avec l'éponge font paroître de l'écume, il reste du blanc d'oeuf qu'il faut enlever.

Cette operation, ou application intermédiaire du blanc d'oeuf, entre la confection du tableau de prix et l'application des vernis, a le double avantage de défendre les couleurs des impressions nuisiblès de l'air et de l'humidité, et de les dépouiller d'une teinte jaunâtre qui ressort de l'huile, ou, peut-être, des couleurs elles-mêmes. Ces conditions étant rigoureusement observées, les couleurs paroissent sous le vernis avec tous les développemens et toute la richesse de leur teinte.

Quelques Peintres Anglais, trop avides de jouissance, et qui se pressent de recueillir les fruits de leurs compositions, négligent toutes ces précautions. Plusieurs Artistes peignent même dans le vernis, et l'appliquent avec les couleurs. Cette méthode précipitée, donne du brillant à leurs compositions, au moment même de leur création; mais elle ne leur procure qu'une jouissance trompeuse éphémère. Elle leur enlève la (p. 134) possibilité de nettoyer leurs tableaux, qui sont sujets, d'ailleurs, aux gerçures et à l'extinction des couleurs. Enfin, il n'est pas rare de voir l'Artiste survivre à son chef-d'oeuvre, et n'avoir plus rien à attendre de la postérité.

Tout ce qui tient à l'art du coloriste par impression, n'est pas étranger à celui de la peinture par excellence: de même aussi, les préceptes admis par les peintres célèbres, ne doivent point échapper à l'attention et à la recherche du vernisseur, auquel la peinture confie ses plus grands intérêts.

F.X. Burtin, *Traité théorique et pratique des connaissances qui sont nécessaire à tout amateurs de tableaux* [...], 2 vols., Bruxelles 1808, vol. 1

chap. XVI
Des Vernis employés sur les Tableaux, Article Premier Des mauvais Vernis.

(p. 428)
Les plus communs, entre ces moyens destructeurs des tableaux et ces ingrédiens qui rendent les vernis si nuisibles, sont le blanc d'oeuf, la colle de poisson, l'huile, la gomme copal, le succin, et tous les vernis faits à l'esprit-de-vin, à l'huile ou à l'eau.
(p. 429)
Personne n'ignore, que le blanc d'oeuf et ses semblables font gercer et fendre, en peu de tems, toute peinture nouvelle. Mille et mille expériences malheureuses ont mis cette vérité hors de doute. Je puis en attester autant de tous les vernis à l'eau, qui sont parve-nus à ma connoissance, et qui deviennent la ruine de tant de tableaux modernes, par l'habitude où sont la plupart des peintres d'en mettre sur leurs ouvrages, pour obvier au mauvais effet qu'y produisent toujours les couleurs embues, jusqu'à ce que le temps les ait remises d'accord avec les autres couleurs. [...] (p. 430)

J'eus beau lui protester, qu'il accusoit à tort les huiles d'un mal, qui n'avoit sa source que dans les vernis à l'eau, ou le blanc d'oeuf, qu'il se hâtoit toujours de metre sur ses tableaux pour leur donner leur éclat; je ne pus jamais le convaincre d'une vérité si évidente, nonobstant le cas qu'il paroissoit faire de mon jugement dans d'autres parties de son art! Tant il est vrai, que même les plus grands hommes tiennent très-fort à leurs erreurs!

Heureux, si ces remarques peuvent persuader quelques artistes; sur le danger des vernis à l'eau, du blanc d'oeuf et d'autres matières du même genre; je ne puis que recommander à ceux qui, malgré mes raisons, s'obstineroient à en faire usage, de vouloir bien au moins en diminuer les mauvais effets, en y mêlant toujours une quantité (p. 431) proportionnée de sucre candi le plus blanc, fondu dans une décoction saturée de coloquinte. Celleci écartera les mouches, le sucre donnera au vernis une certaine souplesse, qui l'empêchera de faire gercer les couleurs.

Les effets destructeurs du blanc d'oeuf et autres choses sembla-bles ne sont nullement bornés aux seuls tableaux nouveaux! Il est prouvé, par une infinité d'exemples, qu'ils produisent le même effet, sur les tableaux les plus anciens, dans un tems plus ou moins

long, en proportion de la vétusté ou de la dureté des peintures. C'est ainsi que j'ai vu, dans la galerie des ducs régnans de Brunswic, d'excellens tableaux italiens, très-épais en couleur et peints depuis deux siècles, par conséquent très - durs, dont le blanc d'oeuf étoit parvenu, à la longue, à faire retirer et à séparer tellement les différentes parties en une multitude de ronds et de lozanges irréguliers, qu'on y voyoit des interstices, de plus d'une ligne entière de largeur, qui laissoient la toile à découvert. [...]

(p. 444)

Depuis long-tems les restaurateurs des tableaux, sachant que le vernis ne prend jamais bien sur la surface huileuse et grasse d'une peinture trop nouvelle, avoient adopté l'usage, pour pouvoir vernir d'autant plutôt les tableaux qu'ils avoient repeints ou retouchés, de les couvrir d'abord d'une couche de blanc d'oeuf. Les pernicieux effets de celui-ci, trop bien connus aujourd'hui, lui ont fait substituer, depuis peu, une dissolution de colle de poisson, qu'on a également tort, selon moi, d'employer. Je puis dire ceci d'autant plus qu'en mettant dans les couleurs de retouche la quantité requise de sel de saturne, et en (p. 445) exposant ensuite les tableaux avec la couleur au jour, dans en endroit aëré et assez chaud, on peut très-bien les vernir au bout d'un mois et souvent même plutôt, en se servant d'un vernis très - liquide; qualité, qu'on peut obtenir facilement par l'addition d'une dose suffisante d'huile de térébenthine: pourvu néanmoins, que les couleurs nouvelles ne soient pas trop empâtées et ne forment pas des masses trop considérables.

M.P.L. Bouvier, *Manuel des jeunes artistes et amateur en peinture,* Paris 1827

(p. 545)

XXXI^e^ LECON.

Vernis au Blanc d'oeuf, et manière de l'appliquer aux tablaux nouvellement peints en attendant qu'ils soient assez secs pour y mettre le véritable Vernis.

Quand on a achevé un tableau à l'huile, il faut le laisser sécher jusqu'à ce qu'aucune des couleurs ne piosse plus sous les doigts. Il y a encore une autre manière de connaître si la dessiccation est assez avancée pour y mettre le blanc d'oeuf; c'est en poussant la respiration dessus: si les couleurs sont encore trop fraîches, le nuage de la respiration disparaît sur-le-champ ou ne se forme même pas du tout sur la superficie de la couleur; si, au contraire, le nuage est bien visible et qu'il trouble l'apparence des couleurs en y restant quelques instans sans s'évaporer, c'est un indice qu'elles sont assez sèches pour pouvoir sans risque recevoir l'application du blanc d'oeuf.

L'on ne peut pas assigner un terme après lequel les couleurs doivent être suffisamment sèches: cela dépend de plusieurs circonstances, telles que la qualité de l'huile et des couleurs qu'on a employées, la franchise ou la timidité avec lesquelles la couleur a été maniée; mais surtout la température et l'état actuel de l'atmosphère, chaude ou sèche, humide ou froide. Un tableau séchera mieux en été en huit ou dix jours, qu'en six ou huit semaines en hiver. L'on peut compter qu'il faut au moins dix ou douze jours en été, et deux mois en hiver, et quelquefois plus, avant qu'un tableau soit assez sec pour se hasarder à y appliquer le blanc d'oeuf. (p. 546) Les couleurs brunes, les noires, ainsi que toutes les laques et les cinabres, sont long-temps à sécher, surtout quand elles sont employées pures et comme glacis, sans mélange d'aucune autre couleur siccative(1), à moins qu'on ne les emploie à l'huile grasse presque pure, ce qui les ternit beaucoup. D'ailleurs ce n'est pas la couleur dans ce cas qui est sèche ou qui paraît l'être; c'est la peau qui se forme sur l'huile grasse qui donne le change: or, plus cette peau se forme promptement, moins elle permet à l'huile, qui est renfermée dessous cette peau, de s'évaporer.

Il ne faut donc pas être trop impatient d'appliquer le blanc d'oeuf; il en résulterait souvent des accidens qui affligent l'artiste: la couleur se gerce et s'éfendille en tous sens, parce qu'étant fortement grippée par le blanc d'oeuf, celui-ci lui fait lâcher prise sur la tiole, qui se grippe moins fortement.

C'est donc en palpant du bout des doigts les couleurs les plus longues à sécher, ou en poussant son haleine dessus, qu'on peut connaître à quel point de dessiccation se trouve un tableau.

Je dois dire en passant qu'on n'applique ce faux vernis ou ce blanc d'oeuf que pour jouir de la vue de l'ouvrage, le juger, le faire juger par d'autres avant qu'il soit assez sec pour le vernir; car sans cela il vaudrait mieux le laisser sécher tout naturellement au grand air sans blanc d'oeuf. Un tableau est tellement embu par places et reluisant en (p. 547) d'autres places, qu'il est impossible d'en concevoir une idée passablement juste, si l'on ne fait disparaître toutes les taches et inégalités par un vernis qui puisse facilement s'enlever et se renouveler sans empêcher la peinture de continuer de sécher.

On prétend que le blanc d'oeuf accélère la dessiccation plutôt que de la retarder: je ne saurais l'affirmer; mais je puis assurer que, pourvu qu'on ne se hâte pas trop de l'appliquer, et qu'auparavant le tableau ait été bien lavé, comme on va l'expliquer, je ne me suis jamais aperçu qu'il nuisît à la peinture.

Comment on lave un Tableau avant d'y mettre le Blanc d'oef.

On aura une éponge fine, très-douce, et beaucoup d'eau de fontaine très-claire, et qui ne laisse aucun dépôt; on lavera le tableau à grande eau et en frottant très-légèrement: le mieux est de placer le tableau au-dessous d'un robinet, afin que l'eau se renouvelle constamment.

Quand le tableau aura été ainsi lavé pendant quelques minutes, on exprimera l'eau de l'éponge, et l'on essuiera doucement le tableau avec cette éponge, qui humera le restant de l'eau. L'on n'essuiera d'aucun linge la légère humidité restante sur la peinture; mais, comme il faut qu'il n'en reste aucune trace, on exposera le tableau au grand soleil, ou, si l'on ne peut faire mieux, on le présentera devant un feu de flamme claire, en le tenant à quatre ou cinq pieds de distance du feu, et en remuant le tableau et le tournant sans cesse du haut en bas pour qu'il sèche également, et sans qu'aucune place ressente trop de chaleur. Il ne faut pas que le tableau (p. 548) devienne sensiblement chaud; cela gâterait les couleurs: il suffit qu'il n'ait plus d'humidité ni de chaleur, pour y appliquer le blanc d'oeuf.

Manière de préparer le Blanc d'oeuf et de l'appliquer.

On sépare soigneusement le blanc d'un oeuf bien frais d'avec le jaune, puis on bat ce blanc; après y avoir ajouté une cuillerée à café d'esprit de vin et un peu, mais très-peu, de sucre candi, qu'on aura fait fondre d'avance dans la moindre quantité d'eau possible(2), on

bat le tout ensemble, soit avec la barbe d'une plume, soit avec une cuiller d'argent, jusqu'à ce qu'il soit presque tout en écume.

Avant de battre l'oeuf, on aura une éponge fine qui aura été humectée et ensuite pressée et essuyée dans un linge, afin qu'elle n'ait plus que l'humidité nécessaire pour avoir de la souplesse.

On plongera l'éponge ainsi préparée dans l'écume, et on la passera promptement et régulièrement sur toute la superficie du tableau, sans revenir plus de deux fois sur la même place, et on le laissera sécher, ce qui a lieu au bout de quinze ou dix-huit minutes.

Je préviens que l'écume laissera quelques petits bouillons sur la toile; mais il ne faut pas s'en mettre en peine, ils disparaissent sous le bout du doigt quand le blanc d'oeuf est entièrement sec. (p. 549) D'ailleurs, il y a un moyen d'éviter ces bouillons d'écume, en ne frottant la toile avec l'éponge que légèrement et sans revenir plus souvent que deux fois sur la même place; car, bien loin de mettre beaucoup de ce vernis, il ne faut, au contraire, en appliquer que le moins possible. C'est pour cette raison qu'on le réduit en écume, afin qu'il n'en reste que fort peu sur la peinture, et que l'huile puisse encore s'évaporer à travers les pores du blanc d'oeuf, ce qui n'aurait pas lieu si on lui donnait trop d'épaisseur et de consistance.

Je me trouve ici en contradiction avec plusieurs personnes, qui disent que la partie du blanc d'oeuf qui ne s'est pas convertie en écume, et qu'on trouve au fond du vase, est celle dont il faut se servir, parce qu'elle offre un vernis plus fort et plus reluisant. Cela est vrai, et c'est précisément pour cela que je ne conseille pas d'en faire usage, attendu qu'il n'est point question de produire un vernis plus dense, plus compacte que celui que je propose; au contraire, il est essentiel qu'il soit assez léger et poreux, pour qu'à travers son enveloppe l'excédant de l'huile qui doit se dégager des couleurs, puisse se faire sans obstacle: sans quoi il vaudrait encore mieux mettre le véritable vernis tout de suite à la place du blanc d'oeuf.

Je n'ignore pas, qu'à Paris surtout, la plupart des artistes, pressés de jouir de l'ensemble général de leurs productions, ou obligés, en quelque sorte, de présenter leurs tableaux à l'exposition avec tout ce qui peut les faire valoir, n'y regardent pas de si près, et les vernissent de suite, sans attendre que les couleurs soient suffisamment sèches; mais en cela ils font un grand tort à leurs (p. 550) ouvrages: ils emprisonnent le dessous, qui dès ce moment ne peut plus sécher, et leurs ouvrages roussissent, noircissent, et perdent une grande partie de leur mérite.

Si l'on met le blanc d'oeuf en été, il ne faut pas y faire entrer de sucre, parce que les mouches s'y attachent avec acharnement, et en fort peu de jours détruisent tout l'effet du blanc d'oeuf. Je ne conseille pas non plus d'y ajouter de la gomme fondue, quoiqu'elle donne plus de transparence et de luisant au blanc d'oeuf, par la raison qu'elle couvre trop et bouche trop bien les pores.

Mais ce que je recommande, c'est de changer le blanc d'oeuf tous les quinze jours pendant le premier mois, et ensuite tous les deux mois au moins. La raison en est que l'huile qui transpire s'arrête en partie au blanc d'oeuf, et forme une espèce de crasse, qui finirait par se durcir si l'on n'enlevait pas le blanc d'oeuf. D'ailleurs, je crois avoir observé que le lavage du tableau hâte la dessiccation des couleurs.

Pour enlever le Blanc d'oeuf de dessus le Tableau.

On le lave simplement avec de l'eau bien propre et une fine éponge; l'on fait ce lavage à grandes eaux, jusqu'à ce qu'on ne voie plus aucune trace d'écume, et que l'eau coule du tableau parfaitement pure et claire; puis on exprime l'éponge, et quand elle est presque sèche, on lui fait emboire tout ce qui reste d'eau(3): ensuite on fait sécher le tableau comme je l'ai indiqué plus haut, et l'on y remet un nouveau blanc d'oeuf. Si l'on veut bien faire (p. 551), on ne mettra le vernis à l'essence qu'une année après que le tableau aura été achevé.

Il serait à souhaiter qu'on pût se passer de vernir les tableaux; car le lustre et le brillant que cela donne à la tiole, bien loin d'être un avantage, est un grand inconvénient: d'abord, ils obligent le spectateur à se placer en un seul endroit donné, d'où l'on peut voir le tableau sans être offusqué par le chatoiement du vernis; en outre, les vernis roussissent et noircissent toujours plus ou moins la peinture, et, de plus, rompent les couleurs en écailles au bout d'un laps de temps plus ou moins considérable, ce qui a dégradé la plupart des anciens chefs-d'oeuvre.

La chimie rendrait un grand service aux arts, et surtout à la peinture, si elle découvrait une composition qui fît revivre toute la pureté des couleurs, et leur rendît leur ton véritable et leur vigueur sans le secours d'aucun vernis reluisant; mais cela n'est guère possible: tous les corps mats et non polis, surtout en fait de minéraux, n'ont point la vivacité ni la variété des teintes que le poli ou le vernis leur rend. Le plus beau marbre, la plus belle agate, n'ont rien de séduisant, s'ils ne sont ni polis ni vernis, mais seulement usés: mouillez-les, et à l'instant toute la richesse de ces pierres reparaît: c'est que l'eau, tant qu'elle reste humide, est le plus beau des vernis.

Or, on ne vernit les tableaux que pour leur ôter ce mat, cet embu qui paraît comme un nuage, et qui dérobe à l'oeil tout le charme, toute la vigueur et toute l'harmonie de la peinture. Si l'on pouvait rétablir les couleurs telles qu'elles furent quand le peintre les employa, encore fraiches et liquides, et qu'on pût y réussir sans appliquer un vernis reluisant, la peinture à l'huile aurait (p. 552) fait une immense conquête, et les tableaux se conserveraient bien plus long-temps, car les vernis les endommagent beaucoup.

Les peintures à la gouache, au pastel, à la détrempe, à l'aquarelle, en un mot, toutes les peintures qui ne sont pas à l'huile ou en émail, manquent de force, de transparence et de vigueur. C'est grand dommage, car elles ont un ton argentin que ne conserve pas la peinture à l'huile; mais l'on manque de force dans toutes ces peintures: le noir lui-même devient gris, et l'on n'a aucune puissance pour égaler l'échelle de tons que nous présente la nature, surtout dans les bruns.

[Notes Bouvier]

1. (p. 546) Voyez les premières pages de cet ouvrage, où l'on a indiqué les couleurs qui ne sèchent que très-lentement, et auxquelles il faut ajouter plus ou moins d'huile grasse, au moment de les employer.

2. (p. 548) Pour bien faire, il faut réduire en poudre du sucre candi, et jeter sur cette poudre fine un peu d'eau très-chaude. On fait cela vingt-quatre heures d'avance, afin que presque toute l'eau ait eu le temps de s'évaporer, et qu'il n'en reste que ce qu'il faut pour que le sucre reste liquide et en sirop épais.

3. (p. 550) On évite dans toutes choses semblables d'appuyer

fortement l'éponge et de faire usage de linges à essuyer, parce qu'ils déposeraient toujours quelque peu d'étoupes et des brins de fils.

J. N. Paillot de Montabert, *Traité complet de la peinture*, 9 vols., Paris 1829-51, tome 9 (chap. 575)

(p. 80)
L'usage de blanc 'd'oeuf ou de la colle de poisson a ses inconvéniens, en ce que ces colles retirent et font gercer la peinture fraîche et encore molle; mais notre procédé n'expose à aucun danger.
(p. 81)
Pour les meubles, tels que les bijoux, les boîtes, les étuis, etc., on emploie pour les gommes, le blanc d'oeuf, le sucre candi etc. Ces substances liquéfiées à l'eau ou à l'alcohol produisant de beaux vernis; mais ils ne se conservent qu'autent qu'on les tient à l'abri de l'humidité.

R. de Lasalle, *Manuel complet et simplifié de la peinture à huile suivi du Traité de la restoration des tableaux revu par Thénot*, Paris 1856

Derniers conseils, vernis provisoire, vernis à demeure.

(p. 50)
La nécessité qui existe pour beaucoup de peintres de tirer parti de leurs travaux, dès qu'ils sont finis; l'impatience des amateurs de posséder chez eux ce qu'ils ont acquis; les expositions qui attirent à elles, dans un temps limité, tout ce qui peut être en voie d'exécution, tous ces motifs forcent les artistes à passer sur leurs tableaux une matière qui en fasse disparaître les embus, (p. 51) lesquels en détruiraient complétement l'effet. Or, comme on ne saurait, sans de graves inconvénients, vernir une peinture avant que douze ou quinze mois ne se soient écoulés depuis sa terminaison, on se sert, pour remplacer le vernis, d'un blanc d'oeuf bien battu avec une cuillerée d'esprit de vin et une parcelle de sucre candi.

Avant de se servir de ce quasi-vernis, pour s'assurer que la peinture est bien sèche, on envoie dessus sa respiration; si on la voit se manifester partout sous la forme d'un brouillard qui dérobe aux yeux pour quelques instants l'aspect du tableau, on peut employer le blanc d'oeuf; mais avant, il faut mettre sa peinture sous un robinet et laver à grande eau en se servant d'une éponge souple et fine: puis, avec cette même éponge desséchée, il faut essuyer le tableau, et enfin le faire sécher, soit au soleil, soit à la flamme d'un feu clair, mais d'un peu loin et présenté de côté et non pas de face, car, si la peinture chauffait, vous abîmeriez votre travail. Toutes choses ainsi préparées, prenez une petite éponge fine et souple que vous aurez d'abord lavée, puis pressée, afin qu'il n'y reste pas d'eau, et, ainsi desséchée, plongez-la dans la mousse, produit de l'oeuf battu, et passez-la légèrement et promptement sur toute la superficie de votre tableau, en ayant soin de ne pas revenir plus de deux ou trois fois sur les mêmes places.

Si c'est en été que vous faites cette opération, ne mettez pas de sucre candi avec votre blanc d'oeuf, à cause des insectes qui viendraient s'y attacher.

Je vous recommanderai surtout de changer le blanc d'oeuf tous les quinze ou vingt jours jusqu'à l'application du vernis, autrement la transpiration des huiles, en s'y mêlant, formerait une crasse qui, une fois durcie, aurait mille peines à disparaître, malgré tous (p. 52) efforts. Vous ôterez le premier blanc d'oeuf en lavant à grande eau la peinture et vous ferez votre nouvelle application de blanc d'oeuf, le tout comme il est dit ci-dessus.

Il faut bien se garder de vernir avec du vernis à l'esprit de vin, car on doit toujours penser à la nécessité qui pourrait survenir un jour d'enlever le vieux vernis pour en mettre de frais; or, le vernis à l'esprit de vin ne peut être ôté qu'à l'aide de substances corrosives qui emportent avec lui toutes les finesses et presque tous les glacis.

Un bon vernis à tableaux qui, du reste, se trouve partout, est presque aussi blanc que de l'eau, et en cela on pourrait s'y tromper, car le vernis à l'esprit de vin est aussi fort blanc et fort beau; il faut donc acheter celui dont on veut se servir dans une maison de confiance.

Avant de vernir votre tableau, préparez-le et lavez-le ainsi que nous vous l'avons indiqué pour lui faire subir le vernis au blanc d'oeuf.

Ensuite servez-vous du pinceau appelé queue de morue, et appliquez votre vernis en la passant sur tous les sens en bandes régulières jusqu'à ce qu'il soit bien étendu.

Il suffit de deux couches de vernis, la seconde ne doit être mise qu'après que la première est bien séchée. Ce vernis, qui est à l'essence, est le seul, nous l'avons dit, qu'on doive employer.

[F. F. A.] Goupil-[Fesquet?], *Manuel complet et simplifié de la peinture à l'huile*, Paris 1877

De la Restauration de Tableaux
chap. I *Du dévernissage à l'eau-de-vie*

(p. 57)
Le blanc d'oeuf, lorsqu'il est devenu vieux, n'est soluble ni dans l'eau ni en agissant sur lui par les acides: cela vient de la malheureuse habitude de quelques artistes qui vernissent au blanc d'oeuf pur sans addition de sucre candi ni d'eau-de-vie. (p. 58) Avec de l'esprit-de-vin et de l'huile de térébenthine, on obtient une eau dite à nettoyer, dont se servent d'ordinaire les marchands de tableaux. Le mélange doit se faire ainsi: deux parties d'esprit rectifié avec une partie de thérébenthine; d'autres huiles coupées dans cette proportion donnent les mêmes résultats: telles sont celles d'aspic, de lavande et de romarin.

Les tableaux non vernis peuvent se nettoyer par des moyens plus doux; on peut y employer du levain dissous dans de l'eau; de la farine dans de l'eau de chaux; de l'eau-de-vin ou du vinaigre.

T. Sully, *Hints to Young Painters and the Process of Portrait Painting*, Philadelphia 1873

(p. 23)
The desideration for the best kind of vanish for oil paintings has for a long time been the plague of artists. Some are advocates for 'egg-varnish' for the covering of a newly-painted picture. I believe this to be pernicious. [....]

(p. 25)
In January, 1825, while on a visit to Washington, I made a copy from a picture painted by my friend, Charles King. Being obliged to send the copy to Philadelphia before it was quite dry, I covered the surface with egg varnish, to prevent the action of stickiness in the paint while the canvas was rolled up. (A picture should always be rolled with the painted side outward.) My experiment was quite successful. After the canvas was placed on a stretching-frame in Philadelphia, I removed the egg varnish by the application of pure water with a soft sponge, and the picture was found in good order. The varnish was made as follows: One egg (the contents of the shell except the part called the eye), lump sugar about half the size of the egg, dissolved in the least portion of water. The canvas was 30 by 25 inches.

Egg varnish is thus prepared. In two ounces of alcohol dissolve one-eighth of an ounce of lump sugar, (a piece the size of a nutmeg,) and add the white of an egg. (p. 26) The sugar, reduced to a powder, mixes with the white of the egg, by beating it up into a froth with the alcohol. The varnish is applied with a soft sponge to the picture, which is placed horizontally. I have varnished a picture with this the instant it was dry, and have immediately followed with a coat of mastic varnish, which, by exposure to the sun, would become hard in two days.

W. Roelofs, *De praktijk van het schilderen*, Amsterdam 1919

(p. 53)
Bij het weder onderhanden nemen van een reeds goed droog schilderij, verdient het aanbeveling, eerst die partijen, waaraan men weder wil gaan schilderen, uit te halen, met wat *Vernis Vibert à Retoucher* of *Uithaalvernis der O.H.O.M.* Deze beide vernissen dringen in de poriën der droge verflaag door en zullen het beter vastgrijpen der nieuwe toets op de reeds oude verf bevorderen.

(p. 55)
Schildert men boven een laag, die veel olie absorbeert, zoo ontrekt die grond aan de bovenlaag uwer toets een zekere hoeveelheid olie en maakt de verf mat en kleurloos. Dit geschiedt ook, wanneer men over eene eerste laag verf heen schildert, die half droog is, daar dan deze eerste verflaag de olie ontneemt uit de daarover heen aangebrachte toets.

Door over de ingeschoten verf, zoo zij ten minste droog genoeg is, een dun laagje olie te brengen, kan men deze al uithalen, beter is het echter, daarvoor uithaal-vernis te bezigen.

Olie, die men gebruikt om mede uit te halen, zal op het schilderij bruin en ondoorzichtig worden, als zij droog is; zoodat het afgeraden is, olie te bezigen als uithaalmiddel, zoo men die gedeelten van het schilderij ten minste niet wil overschilderen, nadat men uitgehaald heeft.

Uithaalvernis is een zeer dunne, zwakke vernis, die snel droogt en daarom samengesteld is uit snel drogende vluchtige oliën. De harssoort bij het vervaardigen gebruikt, moet ook niet te stevig zijn en mag geen te sterk aaneengesloten laag vormen bij het drogen. Verdunde schilderijvernis mag om deze laatste reden niet aangewend worden. Is het schilderwerk nog niet droog genoeg, om het met een penseel uit te halen, zoo kan men de uithaalvernis er met een fixeerspuitje op blazen; men moet hierbij echter voorzichtig te werk gaan, daar men heel gauw te veel opspuit en dan de vernis aan het vloeien gaat en de verf ook mede neemt, dus omzichtigheid zij hier bevolen. Het schilderij kan vlak neergelegd en om zoo te zeggen door een regen van uithaalvernis besproeid worden.

Gebruikt nooit eiwit of eiwithoudende uithaal-vernissen. Eiwit gaat na zeer korten tijd tot bederf over, als ieder organische stof, en tast dan de verf aan, hetgeen ook dan nog plaats heeft, wanneer men over de uitgehaalde plekken heen schildert, of deze later definitief vernist. De eiwitdeeltjes, die of op of tusschen de verf zitten, vreten kleine gaatjes in het schilderij en dringen zelfs geheel door het schilderij heen, zoowel naar voren als naar achteren.

Haalt nooit uit met den met speeksel bevochten vinger. Speeksel bevat zeer scherpe zuren, zoo scherp zelfs, dat zij moeten bijdragen om het door ons gebruikte voedsel te helpen verteren. Deze zuren tasten de verf en vernislagen aan. De op oude schilderijen wel voorkomende spieraalvormige barsten zijn vaak een gevolg van het uithalen met speeksel. Het uithalen met den bevochten vinger geschiedt dan ook meestal door den vinger over het schilderij in ronddraaiende cirkellijnen te bewegen.

Sommige schilders zijn echter niet bang om speeksel (p.56) bij het uithalen te gebruiken, zoo de oude Israëls bv. Toen een bekend fotograaf bij hem in het atelier was, om een schilderij te fotografeeren, vroeg de fotograaf hem, om een weinig uithaalvernis, om een paar doffe plekken op het schilderij uit te halen, daar anders die plekken onaangename vlekken op de foto teweeg zouden brengen. Israëls hielp hem direct, door tegen de ingeschoten gedeelten van het schilderij te spuwen, en daarna met de hand dit speeksel uit te wrijven.

Speeksel van iemand, die rookt, bevat behalve de aanwezige zuren nog nicotine, ook iets wat op een schilderij niet thuis behoort.

Suikerwater, honing, enz. zijn evenals eiwit onbruikbaar en gaan tot bederf over. De ei- of suikeruithaalmiddeltjes worden wel als tijdelijk aangewend, met de bedoeling later weer afgewasschen te worden vóór het definitief vernissen, maar dat is af te raden, daar, of vergeten wordt het schilderij goed af te wasschen voor het vernissen of het wordt niet voldoende afgewasschen.

A. Joubin, *Correspondance générale d'Eugène Delacroix*, 4 vol., Paris 1932-1935, tome III

(p. 132)
27 octobre. – Vernis à l'eau d'Ommeganck:
4 onces de gomme arabique.....}
2 onces de sucre candi.....} 1er choix
Les dissoudre dans un demi-litre d'eau tiède et passer dans un linge. – Ajouter un litre d'eau-de-vie de Hollande.

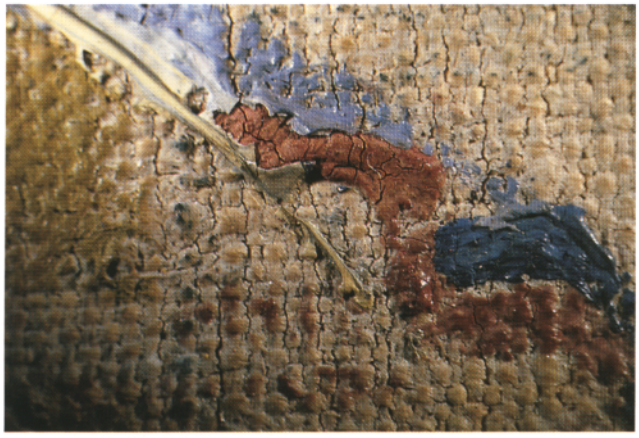
Pour faire prendre le vernis, mettre un blanc d'oeuf qu'on enlève le lendemain avec de l'eau. Ce vernis peut alors se mettre à plusieurs couches et prend très bien.

IV a Vincent van Gogh, *Peach Trees in Blossom, 'Souvenir de Mauve'*, 1888. Otterlo, Rijksmuseum Kröller-Müller.

IV b Vincent van Gogh, *Pink Peach Trees*, 1888. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

v *The Pink Orchard*, detail of the ground in an area of paint loss along the upper edge, showing the undiscoloured pink.

vi *Orchard in Blossom* (Edinburgh, National Gallery of Scotland), detail of the reverse of the unrelined canvas, through which the pink ground has penetrated.

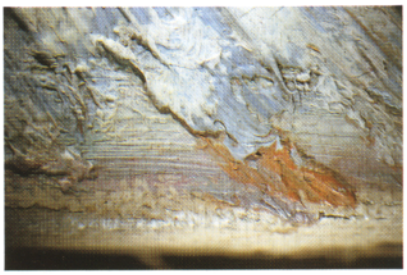


vii *The Pink Orchard*, detail of deteriorated carmine with egg-yolk medium.

viii *The Pink Orchard*, detail of wax penetration (at a point where the canvas and ground are not covered with paint).

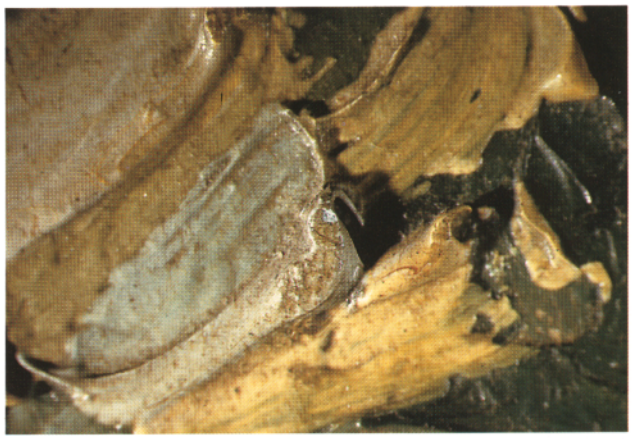
IX *Peach Trees in Blossom*. Detail, 16 x, of the lower edge, normally covered by the rabbet of the frame, revealing a bright orange-red.

X *Peach Trees in Blossom*. Detail, 16 x, of a blossom against the sky demonstrating the dramatic change in the originally strong pink in a broken impasto.



XI *Peach Trees in Blossom*. Detail, 16 x, lower edge showing the discoloured purple-pink in the field.

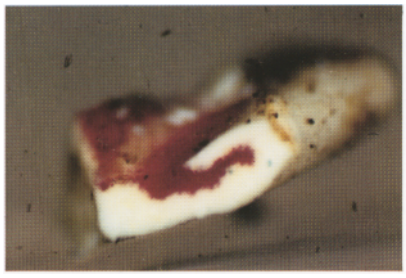
XII *Farmhouse in a Wheatfield* (Amsterdam, Rijksmuseum Vincent van Gogh), detail of the sky area showing the egg-white coating.



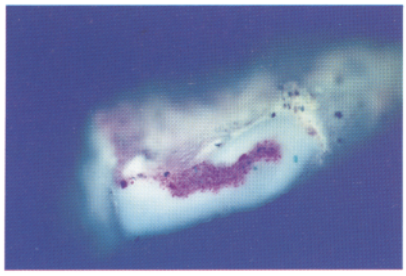
XIII *Undergrowth* (Amsterdam, Rijksmuseum Vincent van Gogh), detail showing grey layer, 16 x.

XIV *The White Orchard*, detail of the surface showing grey layer and grime, 16 x.

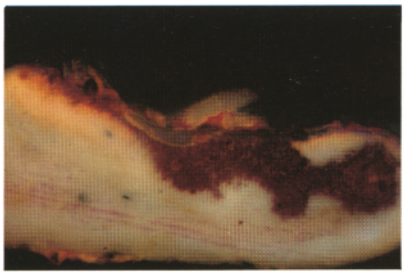
xv The *White Orchard* in UV light.



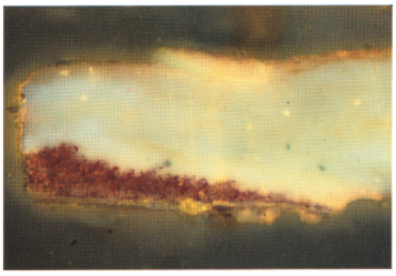
xvi *White Orchard* sample 403-1. Cross-section, 200 x.



xvii *White Orchard* sample 403-1. Cross-section in UV light, 200 x.



xviii *White Orchard* sample 403-1 stained with Rhodamine B for lipids. Cross-section in UV light, 200 x.



xix *White Orchard* sample 403-1 stained with Tetramethyl Rhodamine Isothiocyanate for proteins. Cross-section in UV light, 200 x (air inclusion at the lower edge).

xx *The White Orchard*, detail before varnish removal, 16 x.

xxi *The White Orchard*, detail after varnish removal, 10 x.

xxii *The White Orchard*, detail after enzyme treatment, 16 x.

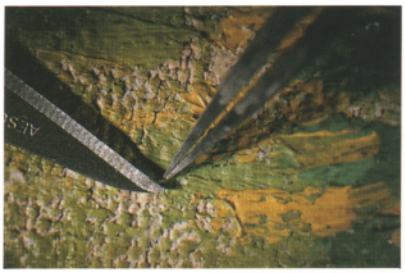
XXIII *The White Orchard* during cleaning, showing the three stages illustrated in figs. XXII-XXIV. The left section before cleaning, the central section after varnish removal and the right after enzyme treatment.

XXIV *The Pink Orchard*, detail of grey area, PVA layer, thin ground, 16 x.

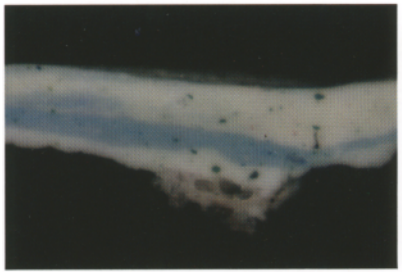
XXV *The Pink Orchard*, detail during cleaning, showing the discolouration of the varnish, 16 x.

XXVI a *The Pink Orchard*, details, 16 x. Application of the Carbopol-acetone gel through tissue.

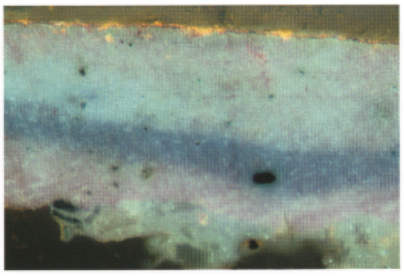
XXXII b *The Pink Orchard*, details, 16 x. The softened PVA is manipulated into clusters with a cotton swab.



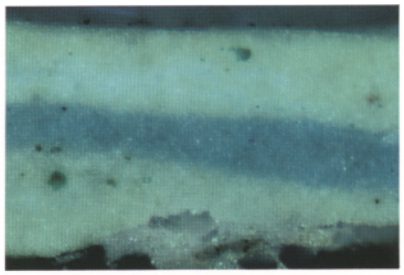
XXXII c *The Pink Orchard*, details, 16 x. Removal of PVA stains with tweezers and scalpel.



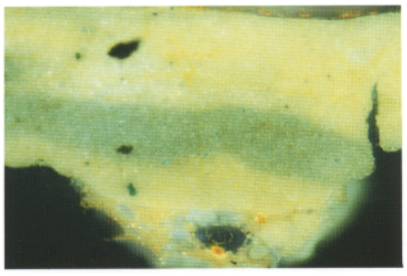
XXVII *Pink Orchard* sample 555-1. Cross-section taken from the sky layer on a pink ground, 100 x.



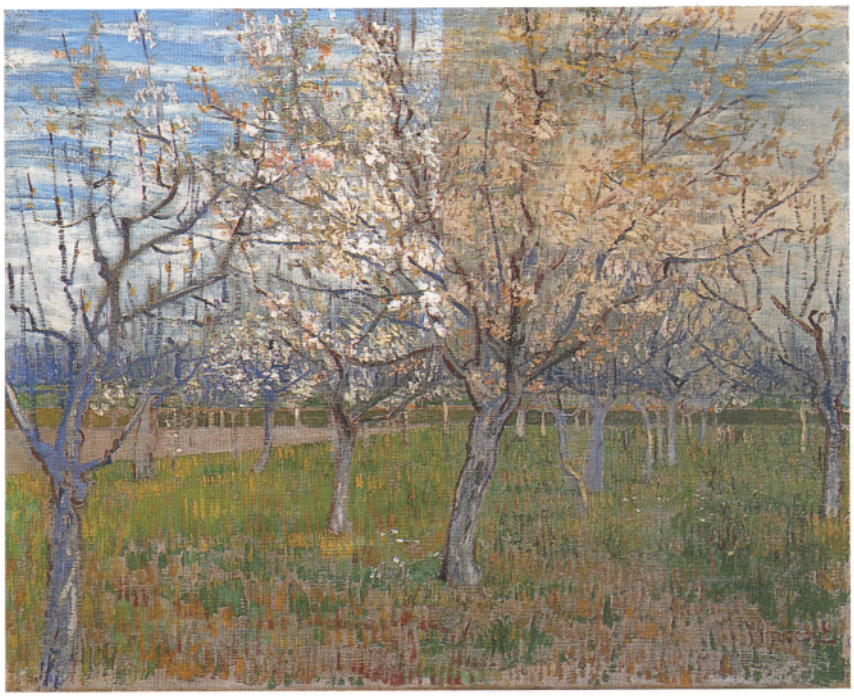
XXVIII *Pink Orchard* sample 555-1, stained with dichlorofluoroscein for lipids. Cross-section, 200 x.



XXIX *Pink Orchard* sample 555-1. Detail of embedded grime in varnish layer. Cross-section in UV light, 200 x.



XXX *Pink Orchard* sample 555-1, stained with Tetramethyl Rhodamine Isothiocyanate for protein. Cross-section, 200 x.

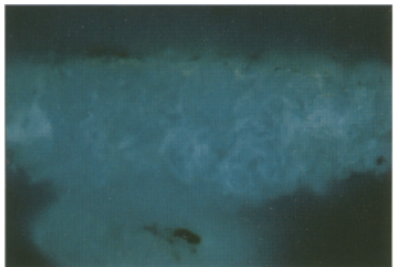


XXXI *The Pink Orchard* during cleaning.

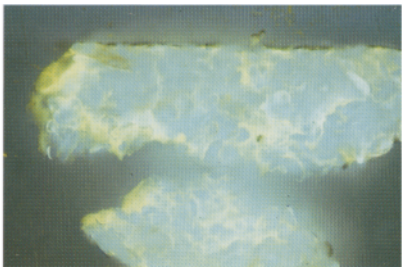
XXXII *Peach Trees in Blossom*, detail before cleaning, 16 x.

XXXIII *Peach Trees in Blossom*, detail during cleaning, after varnish removal, 16 x.

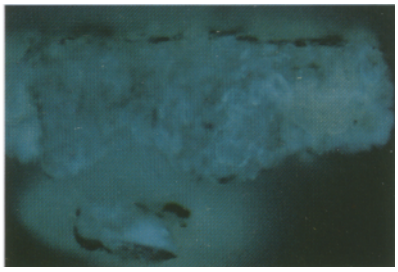
XXXIV *Peach Trees in Blossom*, detail after removal of the egg-white residues, 16 x.



XXXV *Peach Trees in Blossom* sample 404-1B. Before staining. Cross-section in UV light, 200 x.



XXXVI *Peach Trees in Blossom* sample 404-1B. Stained for proteins with Tetramethyl Rhodamine Isothiocyanate.Cross-section in UV light, 200 x.



XXXVII *Peach Trees in Blossom* sample 404-1B. Stained with Triphenyl Tetrazolium Chloride for starch. Cross-section in UV light, 200 x.

XXXVIII *Peach Trees in Blossom*, detail with facing material residues, 16 x.

XXXIX *Peach Trees in Blossom*, detail after cleaning, 16 x.

XL *Peach Trees in Blossom*, detail during cleaning.

Van Gogh's Palette

Mette Marie Bang

While busily at work on his blossoming orchards in April 1888, Vincent van Gogh sent Theo a long list of paints to be ordered from Tasset et L'Hôte in Paris [475]:

20 Blanc d'argent gros tubes
10 idem blanc de zinc
15 Vert Veronèse doubles tubes,
10 Jaune de Chrôme citron id
10 Jaune de Chrôme (No. deux) id
3 Vermillon id
3 Jaune de Chrôme No. trois id
6 Laque géranium petits tubes
12 „ ordinaire „ „
2 Carmin „ „
nouvellement broyés s'ils sont graissés je les renverrais
4 Bleu de Prusse petit tubes
4 Cinabre vert très clair petit tubes
2 Mine orange petit tubes
6 Vert emeraude petit tubes

The order was evidently filled promptly, for in his next letter he acknowledged receipt of all the paints [476]. When he sent the list he had nearly completed *The Pink Orchard*, had just started on *The White Orchard*, and was about to embark upon the second version of the *Peach Trees in Blossom* [477].[1] It is therefore to be expected that the colours ordered from Theo were used in these three paintings, and this is borne out by the pigment analysis carried out by the Central Research Laboratory for Objects of Art and Science, Amsterdam.

WHITES

Van Gogh ordered large quantities of two whites:

20 Blanc d'argent gros tubes
10 idem blanc de zinc

Both lead white and zinc white were discovered in *The Pink Orchard* and *The White Orchard*, and were found mixed with other colour pigments in all three pictures. They were clearly distinguished by the different ultraviolet fluorescence of the two whites,[2] and this was confirmed by the pigment analyses of all three paintings.

The Pink Orchard showed the fluorescences typical of both kinds of white, and contained more zinc white than The *White Orchard*. When he started on his orchard pictures, Vincent told Theo: 'This zinc white that I am using now does not dry at all. If everything were dry I could send off a batch at once' [472]. Curiously, only the quicker drying lead white seems to have been used in the *Peach Trees in Blossom*, which is later than *The Pink* and *The White Orchard*. Vincent was evidently impatient to send the paintings off to Theo, for he ends his letter: 'As soon as the Pont d'Anglais and the copy of the other picture, the pink peach tree, are dry, I'll send them off' [477]. This could be the reason why no zinc white was used in the *Peach Trees in Blossom*.

GREENS

Van Gogh's order of April 1888 specifies three greens:

15 Vert Veronèse doubles tubes
4 Cinabre vert très clair petit tubes
6 Vert emeraude

There is some confusion between the French name 'vert émeraude' and the English 'emerald green'. The French colour name 'vert émeraude' is used for viridian hydrated oxide of chrome ($Cr_2O_3.2H_2O$),[3] while emerald green (copper acetoarsenite) was called 'vert véronèse' in France.[4]

Emerald green was identified in one or two mixtures with yellow (samples 555/3 and 403/9), and in a complex

mixture with chrome yellow, a red lake and a blue pigment, possibly to create a mauve colour (sample 403/8).

A mixture of chrome yellow ($PbCrO_4.PbSo_4$) with Prussian blue was identified in one sample from the green field of *The Pink Orchard* (sample 555/6). This was probably the 'cinabre vert' (chrome green) ordered by Van Gogh.[5] It is possible that he mixed this himself, as he probably did in a light yellow blossom in *The White Orchard* (sample 403/4), where Prussian blue and chrome yellow were mixed with white (although here the yellow was $PbCrO_4$, not the sulphate of the previous sample).[6]

Viridian ('vert émeraude') was found in different mixtures in all three orchard paintings. It was mixed with Prussian blue and lead white for the blue sky in *Peach Trees in Blossom* (samples 404/8, 9), and was also added to the blue-greens in the field (sample 404/13). For the lighter colour in the sky of *The Pink Orchard* it was mixed with lead and zinc white (sample 555/11). For the green-yellow in the trees of *The White Orchard* it was probably mixed with chrome yellow (sample 403/5).

Although not mentioned by Van Gogh, cobalt green was found in two samples from *The Pink Orchard* – one for a grass colour, and another for a very light green mixed with white (samples 555/5 and 555/9).

YELLOWS AND ORANGES

The following yellow and orange paints feature in Van Gogh's list:

10 Jaune de Chrôme citron id [doubles tubes]
10 Jaune de Chrôme (No. deux) id
3 Jaune de Chrôme No. trois id
2 Mine orange petit tubes

Chrome yellows can be manufactured in different shades ranging from light lemon yellow to medium yellow and orange. These are all lead chromate pigments, the lemon variety ('jaune de chrome citron') being a lead chromate sulphate, while the orange (probably the 'jaune de chrome no. trois') contains lead oxide. The medium chrome yellow (probably 'jaune de chrome no. deux') was the most durable of the early pigments; the others often discoloured by turning brown on the surface.[7]

Chrome yellows were identified in all the orchard paintings, but a synthetic yellow lake pigment was apparently mixed with several yellows. Van Gogh does not mention any organic yellows, so it was probably added to some of the chrome yellows by the manufacturer.

Like other organic lakes, the yellow lakes have faded almost completely, and this combined with the discolouration of some of the chrome yellows means all the paintings have lost some of their yellow intensity.

Some of the colours containing chrome yellow have turned brown at the surface. This is seen in *The White Orchard* in light leaves that had probably been a greenish yellow originally (sample 403/9), and in a green used in the grass of *The Pink Orchard* (sample 555/6).

Chrome orange was identified in one sample from the field of *Peach Trees in Blossom*, where it was unevenly mixed with carmine and lead white (sample 404/14).

Van Gogh also ordered two small tubes of 'mine orangé', or orange lead. This was not identified analytically in the samples taken, but it is quite possible that the undiscoloured bright orange used for the fence in the *Peach Trees in Blossom* was orange lead.

REDS

3 Vermillon id [double tubes]
6 Laque géranium petits tubes
12 ,, ordinaire ,, ,,
2 Carmin [petits tubes]

Vermilion was on Van Gogh's list, but has only been identified in small amounts mixed with red lakes (eosine and carmine, samples 404/14, 15, 16, and 555/3).

In the field and the tree of *Peach Trees in Blossom*, bright orange-red colour accents have greyed and become semi-transparent. The intended strength of this orange-red can be seen through breaks in the impasto.

It closely resembled the colour of vermilion, but was identified as eosine lake containing only a little vermilion (sample 404/16). It is not impossible that this was an imitation or adulteration of vermilion.[8]

The three red lakes on the list were 'Laque géranium', 'laque ordinaire' and 'Carmin'. It is not certain precisely what these trade names precisely referred to,[9] but in three paintings the main lakes found were carmine.

As with the chrome yellow, natural weld and a synthetic organic lake were added to the carmine (probably by the manufacturer) in order to give the red a warmer hue. One sample of a lake, discoloured on the surface, showed an interesting fluorescence under ultraviolet light. Under normal light the red area suggests the use of one colour only, carmine, while the UV light exposure indicates the presence of

a different lake in the centre of the sample 403/3 (figs. XLI-XLII, p. 85).

When the results of the sample investigation were combined with an examination of the paint surfaces (along edges protected from the action of light, in cracks, and at recent microbreaks of impasto), it became evident that red lakes had been used extensively for pinks and reds in all three paintings, as well as being mixed with blue for violet hues.

The dark red used for branches and contours in all the paintings were probably unmixed carmine tube colours. They had occasionally discoloured on the surface, but still appeared a dark or brownish red.[10]

Even more catastrophic for the colour impression of the paintings was the bleaching of almost all the pinks in the blossoms of the trees, in the ground of *The Pink Orchard*, in the field of the *Peach Trees in Blossom*, and from the red component of the violet in the field of *The White Orchard*. Where samples were taken from these completely faded red lake components, carmine was identified. (Organic yellows mixed with the reds had also faded completely.)

It is clear from letter 476 that Van Gogh was aware that the red lake colours he was using would fade, but he probably did not realise that the pinks and reds would vanish to quite such an extent.[11] The pinks have faded almost completely, leaving only white or near-white paint behind.[12]

The dramatic bleaching of the unstable red lakes mixed with white to achieve different pink hues can be explained by the Weber-Fechner law.[13] When applied to mixing a colour with white, this law states that to obtain a darker value in a regular series (1, 2, 3, 4, etc.), the amount of darker colour to be added to the white has to be increased in a geometrical progression (1, 4, 8, 16 etc.). Consequently, only a very small amount of carmine has to be added to the white paint to achieve a powerful pink. Conversely, the bleaching of this small amount of carmine is also perceived in accordance with a geometrical progression. This also explains why the discolouration of the darker pink mixtures is less perceptible.[14]

One colour that has not bleached is a bright red in *The Pink Orchard* which was used for brushstrokes in the grass and for the signature (unexpectedly identified as carmine as well).

BLUES

4 Bleu de Prusse petit tubes

The only blue on Van Gogh's list of April 1888 is Prussian blue. Mixed with white, it was found in the samples from the blue skies (in *The Pink Orchard* and *Peach Trees in Blossom*, samples 555/11 and 404/8, 9), and was used pure for dark branches and contours (identified in *The White Orchard*, samples 403/11, 12, but recognisable in all paintings by its characteristic deep, cool dark blue, almost black when pure).

Other investigations of Van Gogh's colours from his Arles period have revealed the presence of ultramarine and cobalt blue – pigments which are also mentioned in Van Gogh's letters.[15] Although not on the list in letter 475, several blues in all three orchard paintings are recognisable by their optical character as being probably either ultramarine or cobalt blue.

CONCLUSIONS

The pigments identified in this investigation generally match the paints ordered by Van Gogh in April 1888.

There is also close correspondence with the investigation done at the Fogg Art Museum of the *Self-Portrait Dedicated to Paul Gauguin* (Arles, September 1888), as well as with paint samples from three other Arles paintings examined as part of the same investigation. There both lead white and zinc white were found.

The Fogg investigation also revealed several shades of chrome yellow, including chrome orange, as well as all three greens and Prussian blue. Red lakes were recognised but not specifically identified. Pigments analysed in the Fogg study which were not found in the orchard paintings were charcoal and bone black, red ochre, red lead, vermilion, ultramarine and cobalt blue. This is partly due to the fact that they were not systematically sampled in the orchard pictures.[16]

Many of these pigments were discovered in the nineteenth century: emerald green was produced commercially from 1814, the chrome yellows and chrome green from the 1820s, zinc white and cobalt green from after 1850, and viridian from around 1860.[17] The lake eosine was made as late as 1871.[18]

Broadly speaking, Van Gogh's choice of paints after his Paris period did not differ from that of the French Impressionists. Investigations of pigments from paintings by Monet, Renoir, Cézanne, Seurat, Manet and Degas show similar palettes.[19]

NOTES

My thanks to Cornelia Peres and IJsbrand Hummelen for their help in the preparation of this article.

1. See letter 474.

2. The zinc white fluoresced yellow-greenish under UV light, and the lead white slightly pinkish or pure white.

3. R.J. Gettens and G.L. Stout, *Painting Materials*, New York 1966, p. 173.

4. According to Ashok Roy in J. Leighton, A. Reeve, A. Roy and R. White, 'The Materials of Van Gogh's "A Cornfield with Cypresses"', *National Gallery Technical Bulletin* 11 (1987), p. 56. Gettens and Stout, op. cit. (note 3), do not mention the name 'vert véronèse'. Its translation in the English edition of Van Gogh's letters as 'malachite green' completes the confusion. See also B. Dunstan, *Painting Methods of the Impressionists*, New York 1976, p. 12, and I. Fiedler, 'Materials used in Seurat's "Grand Jatte", Including Colour Changes and Notes on the Evaluation of the Artist's Palette', AIC *preprints*, 12th Annual Meeting, Los Angeles 1984, pp. 43-51.

5. See Gettens and Stout, op. cit. (note 3), pp. 105-06.

6. H. Kühn and M. Curran 'Chrome Yellow and Other Chromate Pigments,' in R.L. Feller (ed.), *Artists' Pigments: a Handbook of Their History and Characteristics*, Cambridge etc. 1986, pp. 189 and 191.

7. Ibid., pp. 187-200.

8. A recipe of 1787 for a cochineal lake to which vermilion was added is referred to in R.D. Harley, *Artists' Pigments 1600-1835*, London 1982, pp. 137-38. Vermilion may well have been included to improve the permanence of a very fugitive pigment. Several eighteenth-century authors suggest that the lighter, scarlet varieties of carmine were adulterated.

9. See the contribution by Judith Hofenk de Graaff *et al.*

10. Carmine was identified for these dark reds in *The Pink Orchard* and *The White Orchard*, but was not sampled in *Peach Trees in Blossom*.

11. See letter 476.

12. Traces of other colours could have been added to adjust the colour hues, or are contaminants from a dirty brush.

13. See W.J. Muckley, A *Handbook for Painters and Art Students on the Character and Use of Colours* [...], London 1880, p. 30.

14. See J. Albers, *The Interaction of Colour*, Cologne 1970, p. 91.

15. See B.L. Engel, *A Study of the Materials and Techniques Used by Vincent van Gogh*, unpublished manuscript, Intermuseum Laboratory, Oberlin 1975; E. Farrell and R. Newman, 'Van Gogh's Painting Materials: an Analysis of the *Self-Portrait Dedicated to Paul Gauguin* and Other Arles Period Paintings', in Jirat-Wasiutyński *et al.*, p. 34.

16. Farrell and Newman, op. cit. (note 15). Betty Engel, op. cit. (note 15), found a similar palette in her investigation of three Arles paintings from the summer of 1888.

17. Harley, op. cit. (note 8), pp. 84-86, 100-02, and Gettens and Stout, op. cit. (note 3), pp. 109, 174, 177.

18. Gettens and Stout, op. cit. (note 3), p. 114.

19. See G. Bazin, 'Introduction à la technique des peintres Impressionistes', ICOM *Committee for Conservation*, 2nd Triennial Meeting, Amsterdam 1969, preprints, pp. 15-16; D. Bomford and A. Roy, 'Manet's "The Waitress": an Investigation into its Origin and Development', *National Gallery Technical Bulletin* 7 (1983), pp. 13-19; M.H. Butler, 'An Investigation of Pigments and Techniques in the Cézanne Painting, "Chestnut Trees"', *Bulletin of the* AIC 13, no. 2 (1973), pp. 77-85; M.H. Butler, 'Technical Note', in exhib. cat. *Paintings by Renoir*, Chicago (The Art Institute of Chicago) 1973, pp. 208-14; Engel, op. cit. (note 15); Fiedler, op. cit. (note 4); M. Hours *et al.*, 'Matière et manière des Impressionistes', *Annales: Laboratoire de Recherche des Musées de France*, Paris 1974, pp. 5-65, esp. p. 40; A. Roy, 'Monet and the Nineteenth Century Palette', *National Gallery Technical Bulletin* 5 (1981), pp. 22-24; A. Roy, 'The Palettes of Three Impressionist Paintings', *National Gallery Technical Bulletin* 9 (1985), pp. 12-20.

Examination and Treatment

Carol Stringari

The three paintings of the triptych had previously undergone fairly extensive restoration treatments which had altered their readability. Scant documentation survived to elucidate the reasons or materials used for the treatments, so technical examinations were carried out to determine what was present on the surface of the paintings, and if it would be possible to reclaim the surfaces by cleaning without risk to the delicate impasto and sensitive pigments.

They all had highly discoloured surface coatings, darkening and obscuring the clarity of colour so crucial to Van Gogh's professed aesthetic.[1] His attraction to clarity and colour was one of his reasons for going to the south, as he wrote to Theo: 'Wishing to see a different light, thinking that looking at nature under a bright sky, might give us a better idea of the Japanese way of feeling and drawing. Wishing also to see a stronger sun, because one feels that one could not understand Delacroix pictures from the point of view of execution and technique without knowing it, and because one feels that the colors of the prism are veiled in the mist of the North' [605].

The surface coatings on these three paintings imparted an effect of this northern veil or mist which Vincent was trying to escape. The colour values were greatly altered by the deteriorated coatings, and the illusion of space reduced by the overall discoloured film. The general tonality of the paintings ranged from yellow to a grey-brown due to grime and aging resins, causing a dramatic change, most noticeable in the blues and purples.[2] The discoloured coatings did serve to unify the three paintings in a certain sense, yet at the expense of the original intention.

Below the varnishes there appeared to be a grey and semi-opaque layer that was especially disturbing on the light colours and high points of the impasto. The 'sparkling' blossoms applied in thick dabs of pure or swirled colour had lost their effect, and now appeared grey and drab. Embedded in the grey layer was an abundance of grime and particulate matter. The build-up of these coatings and grime in the lacunae of the impasto destroyed the three-dimensionality of the surface, an integral part of Vincent's painting technique.[3] The topography of the surface was greatly compromised by the thick discoloured resins and grey layer.

There are a number of paintings in both the Rijksmuseum Vincent van Gogh and the Rijksmuseum Kröller-Müller, Otterlo, which show the same phenomenon of a grey 'gritty' layer with a considerable amount of dirt embedded in it. It is possible that the dirt trapped on the surface was attracted to the fresh paint, exposed to the elements while Vincent was painting out of doors, or on the terrace where the pictures were kept while drying. 'When,' he asked, 'will you be back and what exactly am I to do about sending things? – for I must get fresh subjects, as most of the flowering in the orchards is over. [...] If you would rather leave them to dry out here, perhaps it would be as well. They are now on a covered terrace to dry' [478].

A subsequent coat of what appears to be egg white applied as a temporary coating could have affixed atmospheric grime to the surface, as well as providing a highly charged surface with a great affinity for bonding additional grime and particulate matter.[4] The presence of this visually distur-bing layer (which was in fact analysed as egg white) and the discoloured varnish was further complicated by additional admixtures of facing and lining residues (wax, flour, PVA, synthetic resins). Visual comparisons with other paintings which had not been treated revealed that the surface coatings were severely compromising the presentation.

When compared with untouched paintings, which had retained their clarity and brilliance of colour, it was clear that the three orchards in question could no longer accurately represent Vincent's emotional response to the landscape or his colour theories. In a letter to the painter Livens, he wrote: 'seeking oppositions of blue with orange, red and green, yellow and violet, seeking *les tons rompus et neutres* to harmonise brutal extremes. Trying to render intense colour

and not a grey harmony. [...] the South of France, the land of the *blue* tones and gay colors' [459a].

The following is a synopsis of the investigation of each painting and the subsequent treatment strategies designed and executed for removing the coatings and residues from the three paintings. The use of the principles and approach to cleaning introduced and developed by Richard Wolbers at the Winterthur Museum/University of Delaware, USA,[5] allowed a safe and 'gentle' removal of the surface coatings which was not possible, in this instance, with traditional solvent mixtures.[6]

Most important to note here is that, before commencing treatment, extensive testing was done to determine whether we could safely uncover a surface which would not appear so compromised as to require extensive restoration. Given their former treatment and the damage sustained from heat and moisture or solvents, we were able to reclaim, via the methods outlined below, coherent paint surfaces with enhanced clarity and depth, notwithstanding certain alterations of values due to impregnation of raw canvas and wax saturation.[7] In addition, the surfaces overall did not require revarnishing to correct the leaching or 'sinking in' of the colours often encountered in these extensively treated surfaces. The changes due to pigment alteration could not be restored in the treatment, and must be accepted as inherent to the materials. It is to be hoped that this study and continued investigation into the organic dyes and pigments used during this period will facilitate the reconstruction of the artist's original intention.[8]

TECHNICAL EXAMINATIONS

When small solubility tests were done at the edge of the paintings with a range of polar solvents and mixtures of solvents, it was evident that the parameters were quite wide and required solvents which were not safe for the paint film.[9] The initial impetus for exploring alternative methods of cleaning was Van Gogh's *Undergrowth* (F 746), which could not be satisfactorily cleaned prior to this project using traditional solvents.[10] It was clear from this treatment that solvents did not solubilise the grey layer below the varnish (fig. XIII, p. 52). This particular painting had a very thick layer of this coating which was readily visible and available for sampling. When a sample was taken of the remaining grey layer and analysed with FTIR, it was found to be proteinaceous, corresponding to an infrared reference spectrum for egg white.[11]

We decided to explore the cleaning systems developed by Richard Wolbers at the Winterthur Museum in Delaware, USA.[12] These particular methods included the use of water-based resin soaps and enzyme solutions, as well as manipulation of traditional solvent mixtures to increase viscosity and expand their solubility parameters (see the individual treatment reports below). Prior to deciding on the cleaning strategy, a number of analyses and examination techniques were carried out.

Technical examination of microscopic samples was done using a reflected-light microscope fitted with ultraviolet light capabilities. Certain organic and inorganic materials will emit fluorescent light when excited with short-wave radiation. This quality is called auto-fluorescence, and can aid in the identification of certain pigments and coatings. Other materials which do not inherently fluoresce can be stained with dyes known as fluorochromes, causing them to fluoresce in the presence of certain functional groups. Cross-sectional samples were taken from the paintings to enable us to characterise more specifically the materials present on the surface and their layer structure using these methods.[13]

The information obtained from cross-sectional examination and staining with reagents was corroborated with Fourier transform infrared, laser microspectral analysis, and thin-layer chromatography done by the supportive staff at the Central Laboratory in Amsterdam.[14] Pigment identifications through organic and inorganic analytical techniques allowed the assessment of pigment alterations and the degree of fading that the colours had undergone. Scanning electron microscopy of several samples was done by Eugena Ordonez at the Museum of Modern Art in New York.[15]

TREATMENT PROCEDURES

The White Orchard

In a letter to Theo of around 11 April 1888, Vincent wrote about *The White Orchard*: 'This morning I worked on an orchard of plum trees in bloom; all at once a fierce wind sprang up, an effect I had never seen before, and returned at intervals. The sun shone in between, and all the little white flowers sparkled' [476].

The painting, as it appeared upon examination, had retained little of this 'sparkle' due to a thick discoloured coating on the surface, below which was found a thinner 'grey' layer. The painting had been lined with a wax-resin mixture to a synthetic fabric. This mixture had penetrated to the surface in some areas, leaving hard lumps of micro-

crystalline wax and resin which were highly insoluble. There were large embedded particles of dirt and grime in the surface coating clearly visible to the unaided eye (fig. XIV, p. 52). Pooled areas of lining residue and yellowed varnish filled the valleys of the impasto, and appeared darker due to their thickness and tendency to trap dirt. Numerous losses, tears and abrasions along the edge of the painting had been stabilised during the earlier treatment, but are still visible.

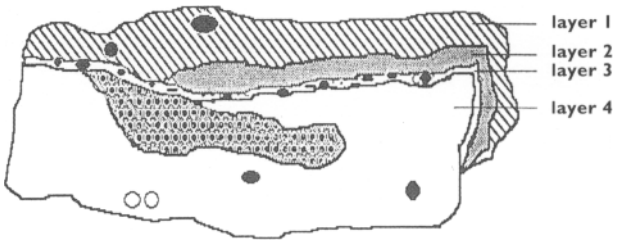
The paint film is relatively stable overall, but some of the impasto areas are pointed and thin, easily subject to breakage. There are some 'blind' areas where air pockets formed below the paint surface, presumably an artefact of the frenetic stippling and hurried brushstrokes. There are areas of broken and misplaced impasto chips, possibly from the former treatment or even from the application of the egg white. Flattened impasto, a common phenomenon, is visible in some areas where another painting may have been pressed against the surface during storage or shipment to Theo.[16] There were several problematic pigments, such as a dark red lake which is now brownish and brittle, with poor adhesive qualities. One of the yellows used was very soluble and appeared 'soft'. Some of these problems may have been created by the wax and high heat in the lining procedure, or even a wax addition in the original formulation.[17] Areas of cracking in the whites are visible with stereoscopic magnification, probably due to the use of zinc, which requires more oil to mix and longer drying time.[18] Visible through the cracks are brilliant areas of pink which suggest fading of pigments.

Examination with ultraviolet light showed a faint milky, yellow-green fluorescence overall, with a bright inherent fluorescence from the white areas of zinc and lead in the paint film (fig. XV, p. 53).

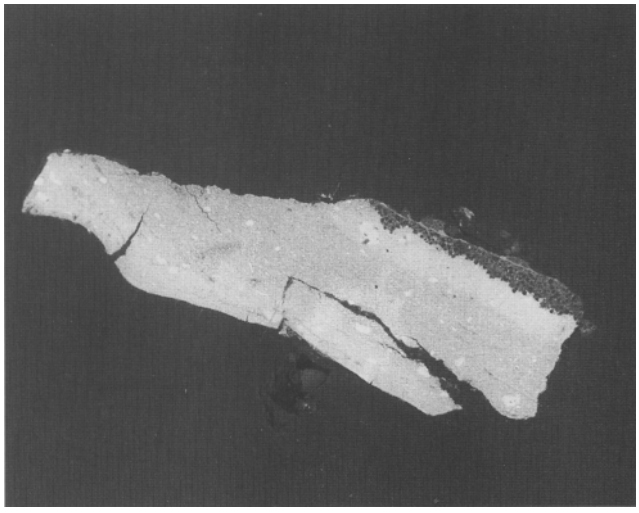
A cross-sectional sample was taken from a broken piece of impasto along the left edge of the painting containing a light blue green of the sky and a bright red of the tree branch. There was a thick discoloured varnish in this area and what appeared to be a 'grey' layer below.[19] The sample contains only the top layers of paint and surface coating without the ground, since it was taken primarily to investigate the surface coatings. The right edge of the sample is a rounded area of impasto, thus the surface coating extends over the right edge. The amount of material to the right of the sample is a good indication of the substantial build-up around the impasto (fig. XVI, p. 53)

The sample was viewed under normal and ultraviolet light under 200x magnification (fig. XVII, p. 53). There were two thick layers with a considerable amount of extraneous material embedded in them, and a much thinner layer below them (*fig. 10*). The yellowed uppermost layer (1) measures 25 microns and has a faint yellow-greenish fluorescence under ultraviolet light. Despite its yellowed appearance, it did not have the expected bright auto-fluorescence, which could suggest that there is an oil component in this resin layer.[20] Layer 2 measures 10-15 microns, fluoresces a bright blue white in the ultraviolet, and contains large embedded particles of grime. The difference in primary fluorescence suggests that the lower layer may be much older or of a different material altogether. The blue white fluorescence is characteristic of an aged egg white, although certainly not sufficient to make a definitive attribution, as wax resin will also fluoresce in this manner. Continued investigation and solubility tests strongly suggest that this second layer (below the resin coating) is wax resin residues from the facing material or lining residues which penetrated to the surface. A recipe given verbally by an associate working at the time of the restoration consisted of white beeswax, microcrystalline wax and gum elemi.[21] The use of this mixture as a facing material which was not thoroughly removed would explain why this second layer in the cross-section is so thick. Directly above the paint film (layer 3) was a thin, 2-micron layer which fluoresced a bright white, with large particles of grime embedded in it.

Staining with fluorescent reagents which recognise specific functional groups revealed several points. When the section was stained with 0.2% Rhodamine B in ethanol, a fluorescent stain for lipids (fig. XVIII, p. 53),[22] the uppermost resinous surface coating stained positive for oil (red-orange fluorescence), while the lower layer did not. This uppermost layer flowed down around the lower one, indicating



10. Diagram of *White Orchard* sample 403-1. Cross-section, 200 x : area of sky with red tree branch, plus surface coatings.
Layer 1: transparent resin/oil surface coating. 25 µ. Layer 2: wax-resin residues. 10-15µ. Layer 3: egg-white layer, 2-5µ. Layer 4: white layer with red tree branch, wet-in-wet, predominantly lead white with large calcite particles: red tree branch: organic lake with tin substrate. *Particles of K, Fe, Al, Si embedded in surface coating (determined by SEM/EDX). Organic analysis: FTIR, TLC. Inorganic analyses: EDX, XRD, LMA.



11. White Orchard sample 403-1. BSE photomicrograph, 100 x.

12. White Orchard sample 403-1. BSE photomicrograph, 4000 x.

that the second layer is not continuous. The paint film itself was slightly positive for oil in the white and brightly fluorescing between the large red particles. It is unclear why the white areas are not more positive for oil, as we have confirmed the oil binder with FTIR. The marginal staining with Rhodamine B may be attributed to the wax penetration from the lining, which could prohibit the stain from coming in contact with the oil binder. Or it may be due to Vincent's aversion to too much oil: 'Now needless to say, we don't care overmuch for oil. If we painted like M. Gérôme and the other delusive photographers, we should doubtless ask for very finely brayed colors. But we on the contrary do not object to the canvas having a rough look, [...] you would get fresher colors which would perhaps darken less' [527].

When the sample was stained with Eosine Isothiocyanate (0.2% in acetone), a stain which reacts with free amino groups in proteinaceous materials, it was apparent that there were actually 3 distinct materials on the surface. A thin layer above the paint film and around the sides of the sample fluoresces a bright pink after staining. The coating extends over the sides of the sample because it is a piece of impasto, and not cut through the painting structure. The top edge of the surface coating also fluoresces for proteinaceous material, which may be grime. Deposition material from the atmosphere on the surface of a painting can often contain proteinaceous materials. The positive layer of protein staining material directly above the paint film may be remnants of an egg-white coating, as it has the same characteristics as other positively identified coatings.[23] This same thin proteinaceous layer was also positive with Lissamine Rhodamine Sulphonyl Chloride (0.2% in acetone), and Tetramethyl Rhodamine Isothiocyanate (TRITC), two other fluorochromes that react with free amino groups on proteins (fig. XIX, p. 53). The definitive characterisation of this egg coating was not possible in this case, but comparative material and staining characteristics suggest its presence. Neither the bright blue white, inherently fluorescing material (layer 2), which may be residues of wax from the facing, nor the uppermost layer took the stain for protein.

The sample was reground and adhered on an aluminum disc and gold/palladium coated for scanning electron microscopy.[24] Energy dispersive x-ray microanalysis (EDX) provided elemental analysis of specific areas within the cross-section, isolating down to approximately one micron. The backscatter image electron image (BSE) provided a clearer picture of the surface coatings and their relative thickness. The size of the grime particles and their position within the layers was easily discernible (*figs. 11-12*). The particles which appear to be firmly embedded in the coatings were found through EDX analysis to contain sulphur, potassium, silica and iron, which are elements found in dirt and possibly clay from the earth. The particles directly on top of the paint film appeared to be surrounded by the thin protein staining layer. These particles are firmly embedded

in the paint film in some areas, and may have been attracted to the fresh paint film while Vincent was working outdoors in stormy wheather. Another possible explanation is that Vincent picked up some clay particles while using a dirty brush. The subsequent egg white coating and restoration treatments may have set them permantly into the paint film.

The EDX analysis done on the red areas of organic pigment found tin as the substrate or mordant material.[25]

The results of the microscopic examination suggested a surface with a wide variety of materials and solubility parameters. When tests were done with solvents and solvent mixtures with varying degrees of polarity and aromatic character, it was evident that very polar solvents were necessary to remove the coating, and that repeated applications were required, which was problematic for two reasons. Repeated applications of solvent allowed diffusion into the paint film, creating a build-up of solvent which eventually left the paint film soft.[26] The discoloured resin/oil varnish required something quite different from the layer below, and was further complicated by the wax-resin residues. It became evident that the only way to minimise the 'grey' layer (which was probably egg) with solvents would be to undercut the film, as aged egg white is insoluble in solvents. We were quite concerned with the appearance of the recovered surfaces after cleaning, as we preferred not to revarnish.[27] Repeated applications of solvents in the test areas left the surface slightly blanched and dry in appearance.

A cleaning strategy was devised to provide considerable control, slower working time and less mechanical action than was necessary with pure solvent mixtures. It was done in a two-step process, addressing the different materials on the surface separately. This ability to use two different cleaning systems was advantageous in that the paint film was protected from exposure to strong solvents. Although the first cleaning solution contained xylene, it was isolated from the surface by its use in a dispersion and by the presence of an insoluble layer below. The second removal stage could be carefully controlled by using a viscous, wholly water-based system (a poor solvent for the oil film below) and by varying the contact time of the cleaning solution according to the sensitivity of the area. An enzyme was added to this mixture to deal with the solubilization of the proteinaceous (egg white) residues.[28]

The uppermost resin/oil layer was removed with a xylene/water mixture emulsified with Triton X-100. The water was adjusted to a pH of 8.4 with a Trizma-HCL buffer with a small addition of triethanolamine.[29] When the cross-section was stained with bromothymol blue, a reagent to determine the relative acidity of the surface coating, both upper layers were yellow, indicating a strongly acidic character. By raising the pH to 8.4, these acidic portions could be more readily solubilised. The paint layer was neutral according to the pH indicator, and therefore not particularly sensitive to a mildly alkaline reagent. It was noted, however, that certain organic pigments were highly sensitive to any solvent or elevated pH. These areas were treated somewhat selectively by varying the contact time and applying the cleaning solution through tissue. It was also noted by dropping the pH even further that the sensitive pigments had less tendency to bleed, although the mixture worked much slower. The xylene/water emulsion addressed both the polar, oxidised portions of the resin and any oily components.[30] The xylene component also acted to soften the wax residues found scattered over the surface. Clearing with petroleum benzine (5% aromatic character) to remove Triton X-100 residues also helped to remove the wax.

The paint film might normally be too sensitive to be subject to a cleaning with the xylene H_2O-emulsion, but in this case the lower grime-laden proteinaceous layer acted as a temporary barrier. The viscosity of the emulsion was also a distinct advantage in that it prevented the solvent from penetrating into the paint film.

The surface of the painting presented quite a challenge. The brittle pointed impasto in the areas of foliage were cleaned with a small soft bristle brush, applying the thick emulsion through tissue, allowing it to sit for approximately 20-30 seconds. When the emulsion was lifted with the tissue, the soft gelatinous mass of dissolved coating could be cleaned from the interstices with the small brush and rounded dental tools, if needed. The cleaning was slow and laborious, but extremely controllable. The only disadvantage to the method, which required a considerable amount of time, was careful clearing of residual material with a hydrocarbon solvent (petroleum benzine with a 5% aromatic character). Application of the emulsion through tissue minimised the amount of residual material to be cleared, since a large percentage was lifted with the tissue.

After removal of a good portion of the uppermost varnish and wax-resin residues, the insoluble grey layer was still obscuring the colour values, and there were still areas of varnish trapped within the impastos where it was much thicker (figs. XX-XXII, p. 53). It was necessary to use a water-based system to denature the protein layer which was tenaciously holding onto the grime. By working with an enzyme incorporated into a Deoxycholic acid soap which was thickened with hydroxypropyl methyl cellulose, the grey layer could be minimised and the embedded grime lift-

ed from the surface (fig. XXIII, p. 54). Deoxycholic acid as a water-soluble salt is a strongly anionic soap. Deoxycholate soapes are surfactants or wetting agents that allow enzymes to make contact with the proteinaceous material without inhibiting their proteolytic activity. Maxatase, an enzyme manufactured by Gist-Brocades which is encased in a 'prill' of a non-ionic detergent, was used.[31] This encapsulation in a detergent enables the enzyme to be less susceptible to denaturation by temperature or moisture during storage and acts as a wetting agent to sequester grime quite effectively as well. The extremely high activity rate of Maxatase compensated for the fact that it was not at its optimum activity temperature, which is higher than room temperature. The deoxycholate soap was buffered with a Trizma-HCL buffer at 8.4, which is the optimum pH for this particular enzyme. By controlling the time left on the surface, the slow activity of the enzyme allowed removal of the disturbing grey layer without biting into the paint surface. There were areas of pitted paint which had small amounts of grey matter embedded in them. This was not removed, because it was felt that an open pitted paint film was not desirable, and it was clear from the SEM photograph that these remaining particles had become an integral part of the film. It is still not clear whether they were embedded in this manner from the outset, or were driven into the film in the lining process, which requires high heat and pressure. These areas had to be accepted as integral to the original structure. The paint film was left intact, with the portion of the protein which had penetrated the film remaining. This has the advantage of protecting the surface of the paint film from weathering, yet it is a strong attractant for grime. The painting will now be placed permanently under glass to protect the surface.

The recovered surface appeared saturated, and the clarity and brightness of the colours were greatly enhanced. The areas of transparent red lake and Prussian blue, predominantly in the branches, are a bit more saturated, as the varnish could only be partially removed in these highly sensitive pigments. We felt this was acceptable, given the fact that Vincent wrote of saturating the darks for contrast.[32]

The Pink Orchard

This is the most distinctive painting in the series, in that it is executed on a heavy-weight, loosely woven fabric which may have been purchased from the local grocer,[33] instead of the usual commercially prepared canvas sent from Paris. The use of this highly textured absorbent fabric gives the surface a dry, matte appearance. *The Pink Orchard* is grounded with a toned pink layer,[34] now altered significantly by adhesive penetration during previous treatment. The deterioration of the canvas itself also renders the thin, exposed ground areas dark. There are many areas within the composition that utilise the exposed ground, and the texture of the fabric is prominent. The overall effect of the surface is matte and dry, due to the quick absorption by the ground and fabric. There is considerable cracking and flaking, and previous treatment has altered the appearance irreversibly. Most disturbing are the now grey areas of exposed ground which should function as pink passages . This irreversible alteration is more prominent in the lower portion below the horizon line, as parts of the sky and blossoms were painted with a thicker paint, stippled with impasto.

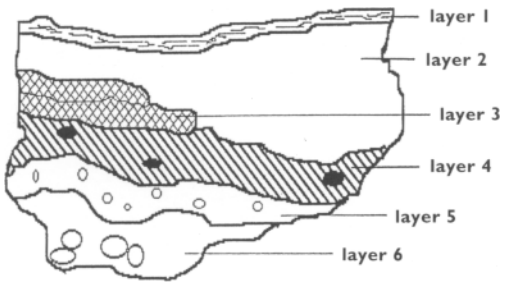
Horizontal cracking evident on the surface and the poor adherence of the ground may have prompted the former treatments. The poor adherence is probably caused by the absorbent canvas soaking up the medium in the paint, leaving poorly bound, friable pigments.

One of the earlier treatment procedures consisted of a wax impregnation only along the top half to correct the instability of the paint film. This wax was subsequently removed on a vacuum table in the early 1960s, at which time a PVA emulsion was used to reline the painting. The formulation TT 79 that was used consisted of:

60 parts polyvinyl acetate dispersion
20 parts polyvinyl alcohol
15 parts gypsum filler
4 parts di-isobutyl phthalate antifoamers.[35]

This lining adhesive penetrated through the open structure to the surface, encasing the exposed ground and pigment in many areas, creating a plasticised effect.[36] In addition, the aging of this material has caused it to become grey and milky, obscuring the colour values considerably (fig. XXIV, p.54).

Only the upper half of the painting, above the horizon line, which is more substantially painted, had been given a thin coat of varnish. This coating is now a greyish brown (fig. XXV, p. 54). Below it is a brown, spotty layer which may be remnants of an early egg-white coating or facing material. When the painting was viewed under ultraviolet light, the upper half faintly emitted a hazy whitish fluorescence, suggesting that it was not a natural resin.[37] In deciding on a treatment strategy, this painting was undoubtedly the most confusing and complex. Furthermore, it was doubtful whether the restored surface would be acceptable, given its poor condition and severe alterations.

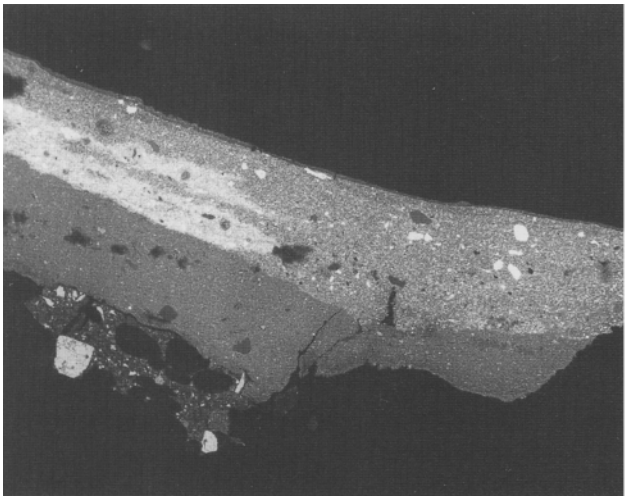


13. Diagram of *Pink Orchard* sample 555-1. Cross-section, 100 x: area of sky. Layer 1:surface coating, 4-5µ, stratified or broken up into several layers: Ketone resin with oil component, wax and rye flour residues (ftir): S and Cl found in significant amounts (EDX). Layer 2: zinc white, lead white, Berlin blue, cobalt green (EDX). Layer 3: zinc white, lead white, viridian, emerald, organic red. Layer 4: zinc white, Berlin blue. Layer 5: zinc white, viridian. Layer 6: zinc, calcite, barium, sulfur; egg-yolk/oil emulsion ground.

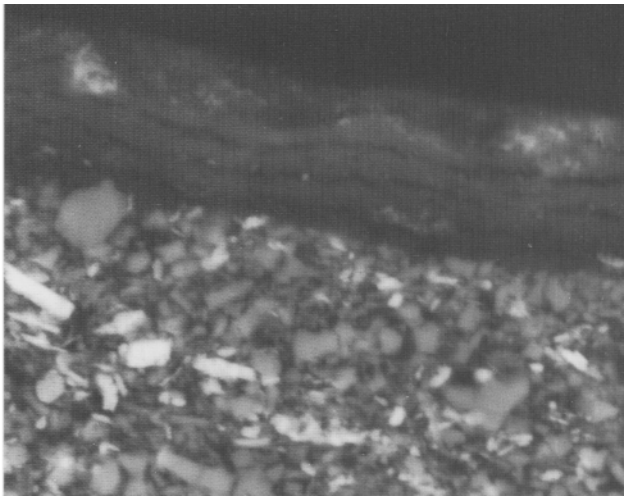
A cross-sectional sample was taken from the top edge in an area of the sky that was flaking, and mounted for examination in a polyester resin. This area appears visually as a bright greenish blue and white over a light greenish layer. The ground below the loss appears pink. This ground layer contains tiny brilliant auto-fluorescent white particles and tiny non-fluorescent red particles. It has an unusual appearance in that it contains large vacuoles (fig. XXVII, p. 55, and *fig. 13*), suggesting an emulsion type formulation. The Central Laboratory detected the presence of certain functional groups which correspond to an FTIR reference spectrum for egg yolk.[38] In addition, an organic red and yellow, zinc, barium and sulphur were found in the ground with LMA, EDX, and XRD.[39] Above the ground is a thick white paint layer with a few large green particles. There is a layer of blue which is swirled in a wet-on-wet method into the white layer which continues above. The surface of the paint film shows a clear coating – a thin transparent layer with large black inclusions.

Microscopic examination with the reflected-light microscope did not allow sufficient resolution to view the stratification of the surface, but SEM revealed at least four thin layers (*figs. 14-15*). The entire surface coating measures approximately 4-5 microns.

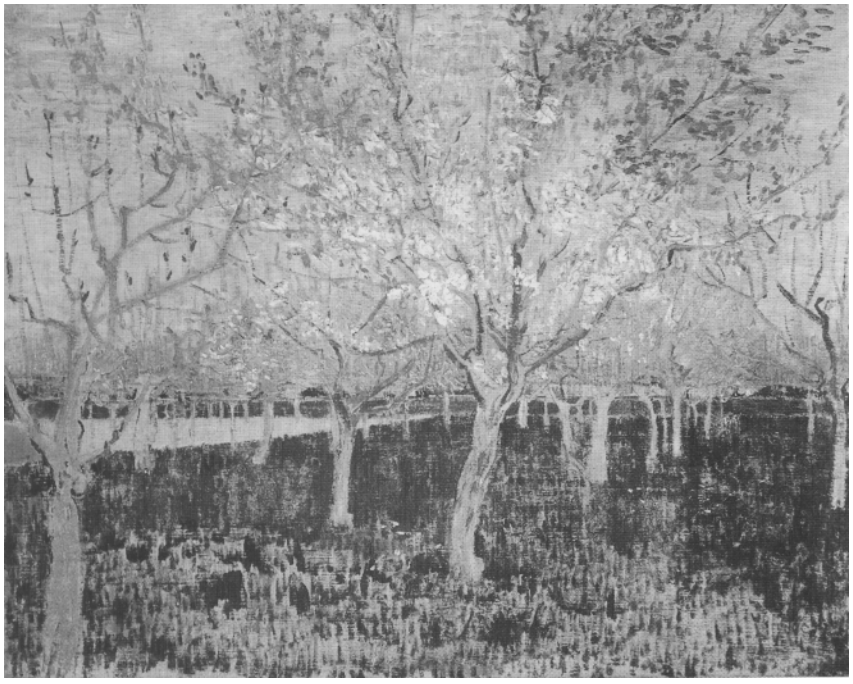
Results of staining with direct reactive fluorochromes were varied, given the admixture of materials from former treatments. When the section was stained for oil with Rhodamine B, the paint layer fluoresced very faintly for oil. This is not surprising, since the paint film is very underbound, and solvents were pulled through to extract the wax. The ground layer fluoresced brightly for oil, which may be an oil/egg emulsion or additives in the PVA which may take up the lipid stain. A stain for the presence of saturation in lipids (no double bonds) or unsaturation (double bond character), 2, 7-dichlorofluoroscein (0.25% in ethanol) (fig. XXVIII, p. 55), revealed that both the coating and the paint film possessed a high degree of unsaturation. This unsaturation in the paint layer may be due to non-drying aromatic or unsaturated lipids being present in these layers.



14. Pink Orchard sample 555-1. The dark spots at upper left are due to grinding. BSE photomicrograph, 80 x.



15. Pink Orchard sample 555-1. BSE photomicrograph, 4000x.



16. The Pink Orchard in UV light.

This would suggest that aromatic solvents might swell or solvate these components of the paint film as well.

The surface coating has a large amount of black grime or particulate matter embedded in it below the surface (fig. XXIX, p. 55). The surface stained very positively in patches with two reagents used to detect protein: Lissamine Rhodamine Sulphonyl Chloride (0.25% in acetone) and Tetramethyl Rhodamine Isothiocyanate (0.25% in acetone) (fig. XXX, p. 55). The EDX analysis indicated sulphur and chlorine in significant amounts in this layer. FTIR confirmed the presence of wax and rye flour. The presence of rye flour may explain the brown staining on the surface. This may have been used as facing material in the earlier treatment, and there is a proteinaceous gluten component in flour which is generally removed in pure starch. This may turn brown with time and become increasingly insoluble.[40]

The surface coating was brittle, dark and discoloured, and cleaned unevenly with a range of polar solvents. Scattered over the surface there were also areas of wax residues used as a facing material in the second treatment. These appeared brown under the stereomicroscope, and were highly insoluble.

The lower foreground portion of the painting was very dry, and many of the pigments were friable and blanched. The PVA adhesive had penetrated to a greater degree here, and had discoloured and become opaque, veiling the brilliant colours below (fig. XXIV, p. 54). No varnish had been applied in the bottom half of the painting, as was evident in an overall photograph taken with ultraviolet illumination (*fig. 16*).

When considering a treatment strategy for this complex work, there were several fundamental considerations.

1. The absorbent quality of the surface, coupled with a network of cracking, gave the surface a high affinity for liquids or solvents of any type, wicking them immediately into the structure of the painting.

2. The mixture of materials on the surface including PVA, wax, resin and flour paste, which required a wide range of solubility.

3. The sensitivity of the paint film to solvents.

4. The upper part of the painting required a separate treatment from the lower part.

The coating on the upper portion of the painting was tested with solvents, which were instantly wicked into the porous and cracking structure of the paint film. When too much solvent was absorbed by the already tenuous ground structure in the lower half of the painting, the PVA encasing it became soft. It was decided that the only way to approach it was to use a viscous poultice-like mixture which would not be driven into the cracks.

The coating responded only to mixtures of very polar solvents.[41] This proved unsafe for the paint film and tended to undercut the paint surface or 'skin'.

Staining with Dichlorfluorescein for degree of saturation/unsaturation had indicated that the surface of the paint film possessed a great degree of unsaturation (double bond character). This could indicate a sensitivity to aromatic solvents which can leach the smaller broken-down portions of the oil film.

A viscous gel was prepared of an acetone and water mixture, using Carbopol 934 (polyacrylic acid) complexed with a weak base (Ethomeen C12) to thicken the mixture.[42] The acetone/water mixture solubilised the acidic and oxidised resin material as well as the highly polar protein residues. To aid in sequestering grime and proteinaceous material, a drop of Lexein S620-TA was added – a collagen based detergent. This material can act as a 'soap' to sequester grime and less polar materials into the solvent-water blend. A very small percentage of benzyl alcohol was added to the mixture. This could be applied to the surface as a nearly solid mass, acting as a poultice, that did not pene-trate the sensitive porous structure. To further insure that the mixture did not penetrate during the working time on the surface, the gel was applied through tissue. This mixture worked quite slowly and was allowed to remain in contact with the film for several minutes while it softened. The mixture was cleared with petroleum ether with a small aromatic component.

The cleaning procedure provided adequate control, so that the solvent did not build up in the sensitive paint film and leave a further degraded surface.

The above procedure was carried out on the upper portion of the painting.

When the varnish was removed there were residues of a wax resin facing as well as the brown staining mentioned above. These had to be treated selectively, through tissue, with the xylene/water emulsion (described in the treatment of the White Orchard above) which addressed the saturated wax and the polar facing residues. In some cases the material on the surface had actually stained the paint film and was impossible to remove.[43]

The lower portion of the painting was a bit more tedious. The paint was dry and crumbly, and there was a film of grey plastic adhesive obscuring the colours. The very dry colours were first consolidated with very dilute B-72, which would not be affected by the cleaning solution, to restore a bit of their body and colour before attempting to remove the PVA. This was necessary because the PVA was actually holding some areas on the surface, and they would have been carried away when it was removed. After tests were performed, it was clear that we did not want to solubilise the PVA, or the entire ground structure would fall apart. The goal was to swell the adhesive on the surface and remove it mechanically. PVA's can be very large polymers and require quite polar solvents to dissolve them. Water appeared to swell it somewhat and acetone quite considerably. The acetone could not be used directly on the sensitive surface, so a gel prepared that was largely water with a low concentration of acetone in it using a Carbopol/Ethomeen thickener to keep it in a viscous state.

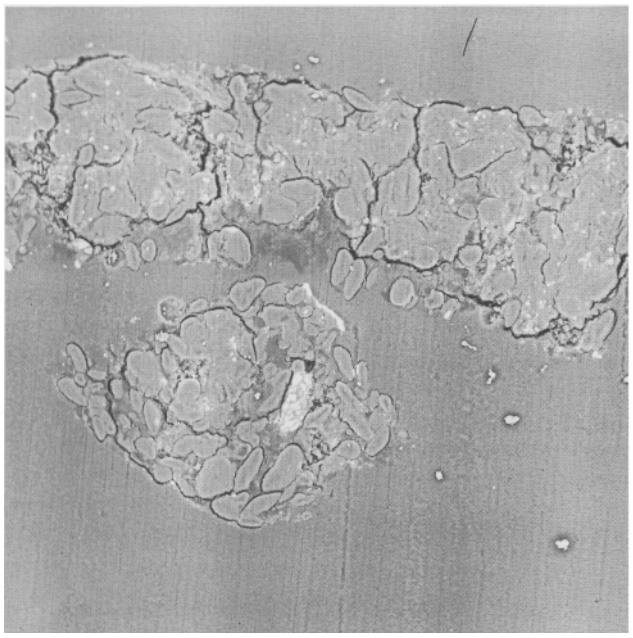
This mixture was applied through tissue and allowed to sit for only a few seconds. This served to swell and coagulate the PVA. When the tissue was lifted, small white spheres of PVA could then be gently rolled or mechanically picked from the surface with tweezers or scalpel, as they were no longer tenaciously encasing the pigment particles (fig. XXVI a,b,c, p. 54). This process was performed under the microscope and was extremely laborious, but the effort revealed the brilliant colour below. The green remained a little leached, although it is not clear if this a result of the treatment, the dry structure of the painting, or former blanching from the moisture in the PVA. Further consolidation with dilute B-72 helped to restore some of the integrity of these colours.

Overall, the painting was greatly improved, being much closer to its original conception as Vincent describes it in his letters, and better integrated into the triptych arrangement. The colour values have altered quite a bit with time due to the presence of fugitive and unstable pigments, yet some of the original brilliance and vitality was restored in the cleaning (fig. XXXI, p. 55).

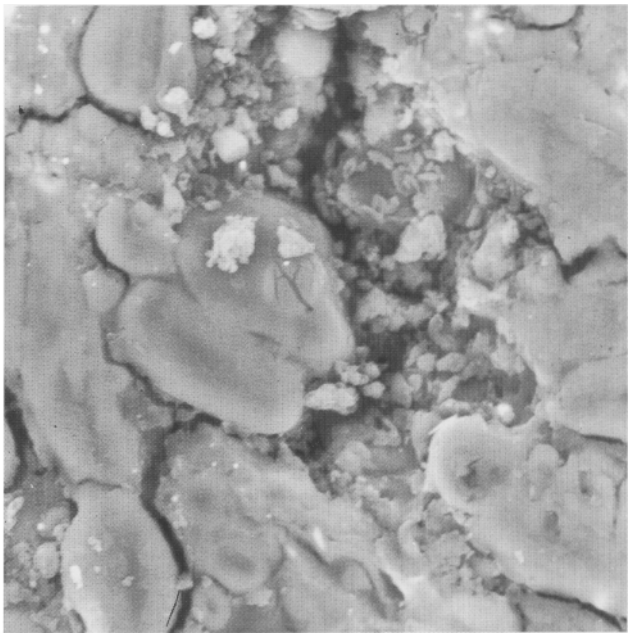
Peach Trees in Blossom

This is the central vertical section of the triptych flanked by the two horizontal compositions. It is closer in technique and character to *The White Orchard* in that it is executed predominantly with a medium-laden paint, and contains areas of highly stippled impasto. The fence is distinct in that it is painted in a thinner, drier fashion, rendering this area matte (fig. 4, p. 29)

This painting had also undergone a fairly extensive treatment in the past to correct flaking problems. It appears from the labels and provenance that it was treated in the 1930s, when it was lined to a supporting canvas with a wax resin adhesive and subsequently varnished with a thick and glossy natural resin coating. The coating had discoloured to an amber tone, destroying the overall colour values, and the excessive gloss made the painting very difficult to read.[44] The varnish clogged the brushstrokes and destroyed the three-dimensional character of the surface, most especially



17. Peach Trees in Blossom sample 404-1B. BSE photomicrograph of coating morphology, 100 x.



18. Peach Trees in Blossom sample 404-1B. BSE photomicrograph of coating morphology, 1000 x.

in the foliage and blossoms. Under the stereomicroscope it was evident that cracking had occurred after the treatment, possibly due to tension and contraction of this thick coating, or to other stresses set up by the heat and drying in the lining procedure. There were areas of flattened impasto and several points where pieces of paint from another painting were attached to the surface. There were many broken points of impasto which were embedded in the varnish. Residues of facing material remained that were lifted and incorporated into the varnish when it was applied (fig. XXXIV, p. 56). These areas appeared turbid, and interfered with the legibility of the painting. This facing material was most disturbing in the fence area, where it appeared as an off-white colour and obscured the brightly coloured brushstrokes below. The facing material was probably most tenacious in these areas due to the friable, dry nature of the paint, which allowed the facing adhesive to be quickly drawn into it. This painting also possessed a grey, 'gritty' layer which has been analysed and characterised as a proteinaceous egg white coating.[45] This layer was not continuous, and was found predominantly in the interstices and the high impasto areas of the tree blossoms (fig. XXXIII, p. 55). It is possible that it was partially removed in the former treatment, at a time when the egg would have still been relatively young. Another explanation for its uneven presence is the 'washing off' that Vincent advised Theo to do [563, 593, 629].

Once again, the treatment strategy was not straightforward due to the diverse materials present on the surface. The topography of the surface was an additional concern, due to the fragility of the peaked impasto.[46] The deep valleys were filled with a thick amber-coloured mixture of degraded materials with a wide range of solubilities.

The painting was in quite good condition overall, and did not lend itself to taking a complete cross-section for examination. Several samples were taken of the surface coating in the area of the fence where the facing material was profuse. These partial sections were viewed under normal and ultraviolet light, indicating that the coating was an amorphous, cloudy yellow mass of material. The fluorescence patterns ranging from light-blue white and yellowish white to darker yellower areas suggested a variety of materials on the surface. These areas appeared as globules of matter embedded in a varnish matrix. The morphology of this mass was further resolved by SEM (*figs. 17-18*).[47]

The unusual appearance of the coating suggested that the varnish had picked up some incompatible water-soluble

material below (e.g. flour paste) and trapped it in the structure. It is clear from these samples that this turbid coating would change the refractive index of the surface and prohibit clear viewing of the surface.

Staining tests with Rhodamine B for lipids indicated a drying oil component in the natural resin surface coating,[48] which was corroborated by FTIR analysis at the Central Laboratory. In addition, the FTIR characterised rye flour as the facing material (*fig. 22, 24*) – the particulate white matter visible in the SEM photo. A sample from an area with a clear, thick grey layer was analysed with FTIR and corresponded to the reference spectra for egg white (*fig. 23*).

Staining with amido black (a non-fluorescent dye for the detection of proteins), Lissamine Rhodamine Sulphonyl Chloride and Tetramethyl Rhodamine Isothiocyanate (all fluorescent protein stains) consistently gave a network of staining in the surface coating (fig. XXXV-XXXVI, p. 56). This staining may originate from the gluten component in the facing material, or the egg-white coating. In order to detect the starch, Triphenyl Tetrazolium Chloride, which turns reddish brown in the presence of carbohydrates, was applied to the sample and gave a scattered pattern of staining the same pattern with a potassium iodate solution (containing iodide), which turns blue in the presence of starch was noted as well (fig. XXXVI, p. 56).[49]

The resin varnish layer was highly auto-fluorescent, a characteristic consistent with the amber discolouration.[50] Degradation of natural resin films results in an increase in absorption in the ultraviolet range, formation of polar products, and yellowing.[51]

The discoloured resin/oil was stained with a pH indicator, bromothymol blue, which reacted as yellow patches in the coating, indicating portions of very acidic, polar material. When stained with 2, 7-dichlorofluoroscein for saturated and unsaturated lipids, the paint film appeared saturated while the surface coating stained yellow for unsaturation in the varnish matrix.

Tests for solubility were done, and it appeared that the varnish required polar solvents to solubilise it. Isopropanol worked efficiently to solubilise the varnish, but required repeated applications. We were concerned with diffusion into the paint film through the cracks and blanching. In addition, the isopropanol was not a good solvent for the embedded flour paste.

The organic reds and yellows tended to bleed on contact with most solvents, and could not withstand repeated applications of alcohols. The alcohol did not, however, solubilise the underlying grey layer, which could act as a 'barrier' while the upper layer was removed.

The substantial amount of paste residue required a water component to solubilise it, so a solution was prepared with isopropanol and water, thickened with a Carbopol/Ethomeen system. This mixture remained on the surface as a highly viscous gel, which allowed time to solubilise on the deteriorated highly polar oxidised resin/oil varnish. The mixture was cleared with petroleum ether with a 5% aromatic content. This step served to remove a significant portion of the thick discoloured varnish (figs. XXXIV-XXXV, p. 56) and some of the facing residues that were embedded in it. The contact time of the gel was determined by the thickness of the coating and the pigments below. The gel was applied with a soft bristle brush and required a minimal amount of mechanical action considering the topography of the surface. The laborious cleaning of the interstices was done in the second step of the treatment, which addressed the residual varnish and the grey proteinaceous grime layer with a water-based detergent/enzyme mixture.

The detergent used was Deoxycholic acid.[52] By mixing it with a small amount of triethanolamine, a basic material, the acid is brought into solution and can act as a soap. The mixture was thickened with Hydroxypropyl Methyl Cellulose, and the pH adjusted to 7.5 in order to remain in a safe range for the organic pigments. To this mixture was added Maxatase LS,[53] a proteolytic enzyme preparation for a range of proteins. A drop of benzyl alcohol was then added to lend a small amount of aromaticity to the mixture in order to increase its overall wetting onto the surface. This enzyme/detergent mixture worked efficiently and was highly controllable to remove the var-nish residues, allowing the enzyme to make contact and work on the egg white. The mixture was allowed to remain on the surface as determined under the microscope and stirred with a soft brush. It was evident when the protein began to denature because the grime particles began to dislodge. This procedure was done with a soft brush, working into the interstices of the impasto. The final rinsing of the surface was done with saliva followed by a petroleum ether with a 5% aromatic component (fig. XXXII-XXXIV, p. 55).

Reduction of the dull semi-opaque greyish layer of egg on the surface greatly enhanced the colour values and the quality of the surface (fig. XL, p. 56), despite the fact that there were significant alterations in colour due to fugitive pigments and dyestuffs.

The topography and sculptural quality of the surface is crucial to the presentation of this painting, and it was restored by removing the build-up of grime and resin in the valleys of the impasto.

CONCLUSION

The successful collaboration and completion of the cleaning of these three paintings was only possible through a thorough investigation of the materials. An understanding of the complexity of the surfaces was crucial in order to utilise the approach based on Richard Wolbers's developments in the cleaning of paintings. We would like to stress the importance of not reducing these methods to formulas, as they are not intended as a panacea or designed to eradicate traditional methods of treatment. Hopefully they will expand the conservator's repertoire of solutions for difficult problems and improve our comprehension of materials used in the treatment of paintings.

NOTES

An abbreviated form of this essay appeared in IIC, *Preprints of the Contributions to the Brussels Congress: Cleaning, Retouching and Coatings*, 3-7 September 1990, pp. 126-30.

I would like to thank Ronald de Leeuw and the staff of the Rijksmuseum Vincent van Gogh for inviting me to participate in this challenging collaborative project. I am extremely grateful to Cornelia Peres, Conservator of Paintings at the museum, who coordinated the work. I would also like to thank Mette Marie Bang, painting conservator, for her contributions.

I am indebted to the staff at the Central Research Laboratory for Objects of Art and Science in Amsterdam for their invaluable analytical work, which aided in understanding the structure of the paintings and planning a treatment strategy. I also acknowledge with gratitude my colleague Eugena Ordonez, conservation scientist at the Museum of Modern Art, New York, for carrying out SEM/EDX analysis, which helped immensely in my understanding of the cross-sectional samples. I also owe a great debt to Richard Wolbers, my former professor at the Winterthur Museum, University of Delaware Art Conservation Program.

Jim Coddington and Terrence Mahon are to be thanked for their helpful criticism and suggestions for improving this essay.

I am especially grateful to Antoinette King, Director of Conservation at the Museum of Modern Art for allowing me the time necessary to complete the project.

1. For his colour aesthetics see J.A. Walker, *Van Gogh Studies: Five Critical Studies*, London 1981, pp. 7-20. In March 1888, Vincent wrote to his sister from Arles [W3]: 'You will understand that nature in the South cannot be painted with the palette of Mauve, for instance, who belongs to the North, and who is, and will remain, a master of the gray. But at present the palette is distinctly colorful, sky blue, orange, pink, vermilion, bright yellow, bright green, bright wine-red, violet.'

2. E. René de la Rie, 'The Influence of Varnishes on the Appearance of Paintings', *Studies in Conservation* 32 (1987), pp. 1-13.

3. See R. Pickvance, exhib. cat. *Van Gogh in Arles*, New York (Metropolitan Museum of Art) 1984, p. 46, who points out the variation in technique within the series of orchards, describing some as having 'structural density with impetuously applied impasto'. The technique of thick impasto was partially influenced by Adolphe Monticelli (1824-86), whom Vincent greatly admired. In November 1885, writing from Nuenen [430], Vincent spoke of his method of applying paint thickly: 'Don't let it trouble you when in my studies I just leave brush strokes as I put them on, with smaller or larger clots of paint. That doesn't matter at all; if one leaves them for a year (or half a year is enough), and then scrapes them off quickly with a razor, one gets a much more solid colour than would be the case after painting thinly. To conserve and keep its colors fresh, it is necessary that the light parts are painted solidly. And this scraping off has been done by the old masters as well as by the French painters of today. [...] You yourself made the observation that my studies in the studio became better rather than worse in colour in the course of time. I think this comes from laying the colors on thickly, and not using oil. When it is a year old, the little oil which the paint always contains has evaporated, and the healthy solid part remains.' There is no evidence that he actually did scrape the works, but it is interesting to note that he was conscious of the lasting freshness of colour and worried about an 'oily' appearance.

4. See the contribution by Cornelia Peres, 'On Egg-White Coatings', for a discussion of the history of egg white as an artist's material and its possible use by Van Gogh.

5. Richard C. Wolbers, 'Notes for Workshop on New Methods in the Cleaning of Paintings', unpublished manuscript, Marina del Rey (The Getty Conservation Institute) 1989.

6. These traditional mixtures are solutions based on solubility parameters determined by the Teas diagram and relative polarity. See J.P. Teas, 'Graphic Analysis of Resin Solubilities', *Journal of Paint Technology* 40 (1968), pp. 19-25, and R.L. Feller, N. Stolow and E.H. Jones, *On Picture Varnishes and Their Solvents*, Washington 1985, pp. 24-43. Another text used for solvent formulations based on increasing polarity was G. Banik, *Lösungsmittel in der Restaurierung*, Vienna 1984.

7. D. Bomford and S. Staniforth, 'Wax Resin Lining and Colour Change: an Evaluation', *National Gallery Technical Bulletin* 5 (1981), pp. 58-65.

8. See also the remarks on pigment alterations in the contributions by Cornelia Peres, 'Painting Technique', Judith Hofenk de Graaff *et al.*, and Mette Marie Bang. For a related study on pigment alteration, see also P. Cadorin, M. Veillon and B. Mühlethaler, 'Décoloration dans la couche picturale de certains tableaux de Vincent van Gogh et de Paul Gauguin', ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, p. 267.

9. See Feller, Stolow and Jones, op. cit. (note 6), pp. 47-113, for a discussion on the diffusion of solvents and the swelling and leaching of paint films.

10. Due to the sensitivity of the paint film, the solvent mixture was thickened with Klucel G, a cellulosic ether, in order to prevent the solvents from diffusing rapidly into the paint film, and to reduce the number of applications. The grey layer below the varnish was not removed by the highly polar solvent mixture (isopropyl alcohol/toluene/MEK) , but was successfully removed with an enzyme soap solution for protein, see Wolbers, op. cit. (note 5), pp. A1-A2.

11. See the contribution by Judith Hofenk de Graaff *et al.* for the methodology, and the contribution by Cornelia Peres, 'On Egg-White Coatings'. Paintings F 403 and F 404 had an apparent

grey layer with the same visual and solubility properties as *Undergrowth* (F 746).

12. See Wolbers, op. cit. (note 5).

13. The equipment utilised was a Leitz Labor-lux 12ME reflected-light microscope with a 150 watt xenon-arc light source. The microscope is adapted for ultraviolet examination with a Pleomopak incident light fluorescence cube with exciting, beam splitting, and suppression filters. The filter combination allows an excitation wavelength in the near ultraviolet range (380-410 nm), and energy emitted by the sample is allowed to pass to the eye. Harmful UV rays are blocked from the eye by the filter system. See E. Becker, *Fluorescence Microscopy*, Leitz brochure on principles, instruments, applications, Ernst Leitz Wetzlar GMBH; R. Wolbers and G. Landrey, 'The Use of Direct Reactive Fluorescent Dyes for the Characterization of Binding Media in Cross Sectional Examinations', AIC *preprints*, Vancouver 1987, and G. Clark and F. Kasten, *History of Staining*, Baltimore & London 1983.

14. For the methodologies see the contribution by Judith Hofenk de Graaff *et al.*

15. See the contribution by Judith Hofenk de Graaff *et al.* for the methodology. All scanning electron microscopy work and photography was carried out by Eugena Ordonez at the Museum of Modern Art, New York. Scanning electron microscopy was done in an ETEC Autoscan SEM coupled to a Tracor-Northern x-ray spectrometer and a GW Electronics backscatter detector. The embedded cross-section samples were mounted onto an aluminium stub with colloidal graphite. A thin coating of gold and palladium was used to cover the sample surface. The samples were analysed using 20 kV as the accelerating voltage. Elements of atomic weight of 11 and up were detectable.

16. Vojtěch Jirat-Wasiutyński and H. Travers Newton, 'The Historical Significance of Early Damage and Repair to Vincent van Gogh's *Self-Portrait Dedicated to Paul Gauguin*', in Jirat-Wasiutyński *et al.*, pp. 3-27.

17. See the contributions by Mette Marie Bang and Cornelia Peres, 'Painting Technique'.

18. R.L. Feller (ed.), *Artists' Pigments: a Handbook of Their History and Characteristics*, Cambridge etc. 1986, pp. 169-86.

19. This grey layer related visually to the above mentioned *Undergrowth* (F 746), which was the impetus for the investigation. The analysis with FTIR of a proteinaceous substance suggesting egg white, and its successful removal with an enzyme, prompted further investigation into the surfaces of the orchard paintings with the same visual characteristics.

20. The upper yellowed resin layer stained very positively for oil, and had visual and solubility properties of an aged natural resin. A subsequent telephone conversation with a conservator from the laboratory where the former treatment was carried out suggested that it may have been a ketone resin varnish, which cross-links and becomes quite insoluble with time. These resins discolour in much the same manner as a natural resin. Standards are being prepared to study the reaction of these resins to the fluorescent stains. The varnish on this painting reacted quite differently to that on *The Pink Orchard* (F 555), which is probably a ketone resin varnish. The addition of oil for flexibility was a common practice, and is often mentioned in technical manuals. Elizabeth Bracht and IJsbrand Hummelen kindly provided the information that the commercial Talens ketone resin available at the time of the treatment contained up to 10% castor oil. They also remember that castor oil was used when the resin was prepared in the laboratory. Castor oil is a non-drying oil which is very viscous and is the heaviest of all the fatty oils, see R.J. Gettens and G.L. Stout, *Painting Materials*, New York 1966, pp. 9 and 36. Castor oils consist chiefly of ricinoleic and iso-ricinoleic acids, with small quantities of stearic acid and dihydroxylic stearic acid, see *Merck Index*, 10th ed., Rahway 1983, p. 265. G.L. Stout, *The Care of Pictures*, New York 1948, p. 16: 'Many of the soft resins are mixed with small amounts of oil to reduce their brittleness, the hard or fossil resins have been fused with oil in their preparation, and the complex process of darkening in oils adds itself to that of the resins in most picture coatings.'

21. This recipe was kindly provided by Elizabeth Bracht, painting conservator at the Stedelijk Museum, Amsterdam.

22. Wolbers and Landrey, op. cit. (note 13). The stains used in this study are discussed in depth in this article. An important point to mention here is that these staining techniques will not identify compounds or give definitive characterisations. They do, however, provide important information about the types of materials or functional groups present in the layer structure of painting, which can help in determining which cleaning solutions will be necessary and which could be harmful for the paint film. They are a valuable method of analysis that is relatively inexpensive and accessible within a working conservation laboratory. Some other related literature on fluorescent staining: G. Clark, *Staining Procedures*, Baltimore & London 1983; A. Xawamura, *Fluorescent Antibody Techniques and Their Application*, Baltimore 1969; M. Johnson and E. Packard, 'Methods Used for the Identification of Binding Media in Italian Paintings of the Fifteenth and Sixteenth Centuries', *Studies in Conservation* 16 (1971), pp. 145-64.

23. Other positively identified coatings for proteinaceous material were on the *Peach Trees in Blossom* (F 404) and Ivy (F 746).

24. This analysis was carried out by Eugena Ordonez at the Museum of Modern Art. The photographs are backscatter images to enhance the absorption characteristics and morphology of the layers.

25. See Judith Hofenk de Graaff *et al.* for a further discussion of pigments.

26. See Feller, Stolow and Jones, op. cit. (note 6), p. 106.

27. See Cornelia Peres, 'On Egg-White Coatings'.

28. For a discussion of the use of enzymes in the cleaning of paintings, and an enzyme bibliography, see Wolbers, op. cit. (note 5), pp. A2 and A9.

29. Controlling the pH of these solutions is essential, as an oil film may be saponified by an elevated pH. In addition, many organic pigments are especially sensitive to alkaline reagents. For a discussion of the importance of pH, see Wolbers, op. cit. (note 5), pp. A30 and C3.

30. Ibid., p. H2. For a thorough discussion of emulsions and their physical properties, see H. Bennett, J. Bishop and M. Wulfinghloff, *Practical Emulsions*, New York 1968.

31. Royal Gist-Brocades NV (Industrial Enzymes Division). Wateringseweg 1, 2611 XT Delft, PO Box 1, 2600 MA Delft (literature available from the above address). We would like to thank Dr Roelck A. Cuperus for her interest and expertise.

32. See the contribution by Cornelia Peres, 'On Egg-White Coatings'.

33. See the contribution by Cornelia Peres, 'Painting Technique'.

34. This layer was characterised through FTIR as containing zinc, barium sulphate, protein and lipid characteristics suggesting egg yolk, as well as carminic acid, luteolin, and apigenin (yellow synthetic dyestuffs detected with TLC).

35. The scant surviving documentation cited TT 79, which is no longer available, as the PVA emulsion used. A conversation with G. Alting at the manufacturer, National Starch Chemicals B.V. of Zutphen, provided the components in the formulation.

36. The properties of PVA emulsions are discussed in R. Houwink and G. Solomon, *Adhesion and Adhesives*, vol. 1, Amsterdam 1965, pp. 297-302.

37. Elizabeth Bracht, painting conservator at the Stedelijk Museum, Amsterdam, recalled that an AW2 or MS2a may have been used, which would explain the unusual fluorescence and staining characteristics. For a discussion of the ketone resins and their properties, see E. René de la Rie, *Stable Varnishes for Old Master Paintings*, (diss. Amsterdam 1988), Meppel 1988, pp. 129-43.

38. A.P. Laurie, *The Painter's Methods and Materials*, New York 1967, p. 43: 'There are two ways in which an egg-emulsion can be used. By the addition of the white, but still better with a little of the yolk of egg, to a sticky varnish or sticky balsam, or sticky thickened oil, it is possible to obtain a medium which is crisp and will not flow. By the addition of more egg and water it is possible to obtain a medium which will mix with water and paint out like a size medium and dry dead and flat.'

39. See the contribution by Judith Hofenk de Graaff *et al.*

40. C.V. Horie, *Materials for Conservation*, London 1987, p. 140.

41. One of the mixtures that worked, but was far too strong for the paint film, was 2 parts isopropanol, 2 parts toluene, 1 part methyl ethyl ketone.

42. For product literature on Carbopol: BF Goodrich Co. Chemical Group, PO Box 122, Avon Lake, Ohio 44012, and on Ethomeen: Armak Chemicals/Akzo, 300 South Riverside Plaza, Chicago, Illinois 60606.

43. A facing recipe used in the laboratory where treatment was carried out at that time was: white beeswax, microcrystalline wax and gum elemi. The addition of elemi may also be a contributing factor to the discolouration on the surface. Elemi is a soluble resin obtained from a tree which grows on the island of Luzon, see R. Mayer, *The Artist's Handbook of Materials and Techniques*, New York 1969, p. 198: 'The purest grade is white, granular, and soft when fresh, but it darkens and becomes harder when aged [...] it is doubtful whether it is stable enough for use in artists' materials.'

44. R.L. Feller, 'Colour Change in Oil Paintings', *Carnegie Magazine* 28 (October 1954), pp. 276-79, 281, 285.

45. See the contribution by Judith Hofenk de Graaff *et al.*

46. J. Leighton, A. Reeve, A. Roy and R. White, 'Vincent van Gogh's "A Cornfield with Cypresses"', *National Gallery Technical Bulletin* 11 (1987), pp. 42-60, esp. pp. 45, 49. This article also discusses and illustrates the problems of cleaning a surface with high, pointed impasto peaks.

47. W. Jarowenko, 'Starch Based Adhesives', in *Handbook of Adhesives*, ed. I. Skeist, New York 1977, pp. 192-211.

48. This oil component was probably added to minimise brittleness and for better handling properties, or it might be an artefact of the resin preparation; see note 20. However, Robert Feller disputes this as an addition in his article 'Dammar and Mastic Varnishes – Hardness, Brittlness, and Change in Weight upon Drying', *Studies in Conservation* 3 (1957-58), pp. 162-74, esp. p. 172: 'It was also demonstrated that the addition of 5 per cent stand oil by volume of dammar varnish did not markedly affect the brittleness observed after six months' drying'.

49. F. Feigli, *Spot Tests in Organic Analyses*, Amsterdam 1975, p. 113.

50. Wolbers, op. cit. (note 5), p. A19.

51. De la Rie, op. cit. (note 37), p. 86.

52. Wolbers, op. cit. (note 5), p. C4.

53. Royal Gist-Brocades, see note 31.

Scientific Investigation

J.H. Hofenk de Graaff, M.F.S. Karreman, M. de Keijzer, W.G.T. Roelofs

The aim of this investigation was to answer a number of questions posed by the conservators during the examination and the treatment of the paintings. It was not a systematic attempt to identify the pigments and media used in order to determine Van Gogh's palette during his Arles period.

The scientific investigation concentrated on two types of problem. The first was related to the strategy which the conservators had chosen for the cleaning of the paintings. Here it was extremely important to identify the different layers in the painting, for it is this that governs the decision as to which layers can be removed with solvent mixtures tailored to the solubility parameters of the layer in question. This is a method which was developed by Richard Wolbers.

Staining tests of cross-sections to characterise the media of the paint layer and the coatings were carried out by Carol Stringari. Her findings were corroborated with the results from the Central Research Laboratory for Objects of Art and Science in Amsterdam.[1] Tests showed that some pigments reacted strongly to certain solvents, and the Central Laboratory was asked to analyse them.

The second problem was related to the fact that a number of pigments, mostly organic, had obviously changed colour. The treatment elicited questions about certain pigments and their visual characteristics, such as fading, changes in hue, darkening and crumbling. These alterations have caused an overall disruption of colour relationships.

A total of 32 pigment samples were taken: 11 from F 555 (*The Pink Orchard*), 14 from F 404 (*Peach Trees in Blossom*) and 7 from F 403 (*The White Orchard*). The samples were examined under the microscope by all the investigators and discussed, and the strategy was then outlined. An answer could be provided to almost all questions put by the conservators.

If there was sufficient sample matter, all the available analytical techniques were deployed. A cross-section served not only for the microscopic examination of the structure of a sample, but also for microchemical (staining) tests and laser microprobe analyses (LMA).

If not enough material was available, thin-layer chromatography (TLC) and Fourier transform infrared spectroscopy (FTIR) could be combined to analyse the sample in order to obtain more reliable information. In these cases the sample was extracted with ether and water. The extracts and residues were mixed with potassium bromide (KBr) and pressed into pellets. Occasionally, depending on the information required, the whole sample was mixed with KBr and made into a pellet. An FTIR spectrum was recorded from these pellets and interpreted.

The pellets were then dissolved in water, hydrolised, reduced by evaporation and dissolved in methyl alcohol. That solution could then be further examined by TLC. On one occasion this was followed by x-ray diffraction analysis.[2]

Although the main aims of the scientific investigation of the three paintings was to identify faded organic pigments in order to obtain a better idea of the original colour scheme, as well as to analyse the surface layer for the purposes of the conservation treatment, sufficient pigments were identified to give an impression of the materials used.

However, since the questions posed by the conservators did not require samples to be taken of all the colours, these results have been affected by the selective sampling, and do not cover the entire spectrum of colours which Van Gogh used in these pictures.

Common pigments like vermilion, chrome yellow and orange, viridian and emerald green, Prussian blue, white lead and zinc white were found.[3] Comparison of the results with those from other paintings of the same period leads to the conclusion that they are broadly speaking the same.[4]

ORGANIC PIGMENTS

Various organic pigments were identified in the paintings: several variants of carmine, a synthetic organic red, eosine, two yellow organic pigments, weld lake and a synthetic yel-

low. The yellow and one of the red synthetic pigments found in the samples from F 555 and F 404 were the same.

Carmine

The basis for the preparation of all varieties of carmine is the red dyestuff cochineal. This is obtained from the female scale insect *Dactylopius coccus Costa* (formerly *Coccus cacti L.*), and its colouring principle is carminic acid. The *Dactylopius coccus Costa* lives on cactus plants in Mexico and Central and South America, and was first brought to Europe shortly after Columbus's discovery of South America. By around 1550 it had almost completely supplanted kermes, a very similar dyestuff obtained from the scale insect *Kermes vermilio Planch.*[5]

Like most natural dyestuffs, cochineal (carminic acid) is a mordant dyestuff, meaning that the ultimate colour is produced with the aid of an auxiliary – the mordant. The latter can be composed of various metal salts, of which alum ($K_2SO_4.Al_2(SO_4)_3.24H_2O$) is the most common, although iron sulphate ($FeSO_4$) and tin chloride ($SnCl_2$). Calcium salts and cream of tartar are used as auxiliaries.[6]

The actual colour of the chemical complex formed by the metal part of the salt and the colouring principle of the dyestuff (carminic acid) depends on the metal used. In the case of carminic acid it can vary from rose red, violet red to dark violet, due to the aluminium, tin and iron respectively.

In the same way as the insoluble complex of a metal salt and the dyestuff molecule precipitates on a textile fibre, the organic pigment is produced by adding a metal salt to an aqueous solution of the dyestuff. The insoluble metal-dyestuff complex precipitates on the bottom of the vessel. This precipitate is called 'lake'. The dyestuff solution can be obtained either by extraction of the powdered scale insects (or in the case of madder, by extraction of the roots), or by boiling remnants of dyed textiles in an alkaline solution.

In the preparation of a brilliant scarlet lake (carmine), cochineal is extracted with a large quantity of water. Various ingredients such as alum, potassium oxalate and cream of tartar are added, and the solution is allowed to stand for several weeks, during which time the carmine gradually separates as a red powder. The presence of iron, gypsum, chalk and zinc oxide must be avoided in this process, since they render the lake violet.

In other cases the lake is produced with alum and chalk. The extract of the powdered scale insects is mixed with chalk, and then alum is added to the mixture. In this process a complicated precipitate is formed: a double complex of calcium and aluminium with carminic acid, mixed with gypsum and chalk. Because of the double complex, this mixture has a higher lightfastness and bleeds less easily. However, its colour is duller and has a more violet hue than carmine produced with alum alone, and the shade depends largely on the amount of chalk added.

If the basic material consists of shearings of previously dyed textiles, such as wool fibres dyed with cochineal on an alum or tin mordant, the fibres have to be boiled with an alkaline solution to dissolve the dyestuff. Alum and chalk is added to the solution, and the lake precipitates. In this way, too, a double complex of aluminium and calcium with carminic acid is formed. In those pigments where natural potash made from wood or shrubs is used, potassium and magnesium salts can also be found in the lake.

Another variety of carmine is produced when the metal part of the lake consists of tin, with or without aluminium and calcium. A complicated complex of tin, aluminium and calcium with carminic acid is formed, which should have a brighter colour than the ordinary aluminium/calcium lake. The former could have been made by using remnants of red wool, which are frequently dyed with a tin mordant. Although the use of tin is not often mentioned in recipes for organic pigments, it was widely used as a mordant in textile dyeing with cochineal from the middle of the seventeenth century. The invention of this method is attributed to a Dutch textile dyer named Cornelis Drebbel,[7] and it became famous in France for dyeing brilliant scarlet on wool and silk. Since many recipes mention wool shearings as the starting materials for the pigments, one can expect to find tin in many lakes. Recipes for organic pigments often called for a large number of ingredients. For a cheaper pigment, magnesium carbonate ($MgCO_3$) is specified, as is the use of larger quantities of chalk or clay or aluminium hydroxide.

All these pigments were marketed under different names which were generally given to shades of the pigment, and bear no relation to the composition. Common names are carmine or crimson lake, but there are also many fancy names.[8]

The Synthetic Organic Reds

In a letter to Theo of April 1888, Vincent van Gogh ordered six tubes of 'laque géranium' [475]. It is not clear whether this lake was just a special shade of red or whether it was made of a synthetic pigment, namely eosine.

In contemporary books on pigment preparation, the early synthetic dyestuffs used as pigments are mostly referred to as 'aniline' pigments, and are never called geranium lake. The only synthetic pigments mentioned are referred to by

their chemical name, eosine and fluoresceine. In a chemist's handbook, geranium lake is merely described as a special hue of cochineal lake. This confusion of terminology is typical of many of the organic lakes.[9]

Bersch, in the chapter on organic lakes in his manual on the preparation of pigments, mentions only eosine and fluoresceine as useful synthetic dyestuffs.[10]

Eosine was discovered by Caro in 1871. Its sodium salt is a brownish red powder, which has an intense yellow-green fluorescence in water. It gives brilliant red hues when used on wool and silk, with a typical yellow-red fluorescence on the latter. Eosine is made by bromating fluoresceine in water or ethanol and converting it into the sodium salt.

By 1875 both dyestuffs were being used in the textile industry, and as lakes for the printing industry. One contemporary writer states that eosine has a more brilliant shade than carmine obtained from cochineal.[11]. The lake (pigment) is prepared by adding alum to an alkaline solution of eosine. The precipitated lake has a beautiful vermilion red colour. Another lake can be produced with lead salts and eosine.[12]

Fluoresceine, which was discovered in 1871 by Baeyer, is also used as a lake pigment (yellow). The pigment is made by dissolving fluoresceine in an aqueous zinc sulphate solution and adding sodium carbonate, whereupon a bright yellow pigment is precipitated. When this yellow pigment is mixed with eosine lake it produces all shades between scarlet and yellow, depending on the proportions.[13]

Red lakes in the paintings

THE PINK ORCHARD (F 555)

Two red lakes were identified in this painting. The discoloured and crumbled red of the tree consists of a tin/aluminium lake of carminic acid. It is made or mixed with chalk ($CaCO_3$) or dolomite ($CaMg(CO_3)2$. The presence of tin as the metal part of the red lake in this painting was confirmed by SEM-EDX analysis at the Museum of Modern Art in New York.[14] . In the branches and the blossoms of the tree there is another, less faded red lake. Here an aluminium/calcium lake of carminic acid was identified. This lake is mixed with a small amount of vermilion. Both have faded because of their low lightfastness.

Feller mentions a lightfastness of 1-2 on the blue wool/scale, other investigators give 3-4. The difference probably depends on the way the metal complex is formed. However, in all cases it is very low compared to inorganic red pigments, such as vermilion, which has high lightfastness (7-8).

PEACH TREES IN BLOSSOM (F 404)

In this painting eosine was positively identified in the orange dots of the field. The layer is very thin (ca. 2 µ), and the upper part was faded to such an extent that it had become almost transparent. Below that the paint was still orange, as is clearly visible in the cross-section (fig. 000). It is possible that the orange was made by mixing eosine and fluoresceine, although no trace of the latter could be found. A possible reason might be that the layer contained too low a concentration of fluoresceine. No inorganic orange pigment was present.

An aluminium/calcium lake of carminic acid was identified in the discoloured pink of the same field.

THE WHITE ORCHARD (F 403)

In this painting, carminic acid could be identified in a brownish red from the tree. Although faded red organic pigments are present in many parts of the painting, no samples were taken in order to identify them all.

Conclusion

Various red organic lakes were used in the three paintings under investigation. At least three could be identified: a tin/ aluminium lake of carminic acid and an aluminium lake of carminic acid, both made or mixed with chalk or dolomite, and an aluminium lake of eosine mixed with vermilion. It is not clear whether the vermilion was already present in the tube or was added on the palette.

In his letter to his brother [475], Vincent ordered three types of red organic lake pigments: 'laque géranium' (six tubes), 'laque ordinaire' (12 tubes) and 'carmin' (two tubes). It is tempting to identify these 'laques' with, respec-tively, aluminium lake of eosine, aluminium lake of car-minic acid, and the tin/aluminium lake of carminic acid. *(fig. 19)*

Yellow lake pigments

In principle, yellow lakes are made in the same way as red lakes. A mordant dyestuff together with a metal salt forms an insoluble complex. Various yellow dyestuffs can be used as the starting point. Most are flavonoids, which with alum form a yellow complex. The best-known dyestuffs are Persian berries (the dried, unripe berries of various shrubs of the buckthorn family, *Rhamnus*), quercitron (the inner bark of the *Quercus tinctoria*) and weld (the commonest, derived from the plant Dyer's Rocket, *Reseda luteola L.*). Weld

yields the most durable lakes of all. The pigment is made by extracting the leaves of the plant with water and sodium carbonate. Alum is then added to the solution, and the yellow lake is precipitated together with a substrate consisting of gypsum and chalk.[15]

Synthetic yellow lakes

A yellow synthetic pigment identified in the painting *Peach Trees in Blossom* (F 404) could be made from fluoresceine. A separate research project was set up to search for a number of yellow synthetic pigments which might have been present, given their date of discovery.[16] The only possibilities were Martius Yellow and fluoresceine, but the separation in the chromatogram was insufficient to reach a definite conclusion on either.

Conclusion

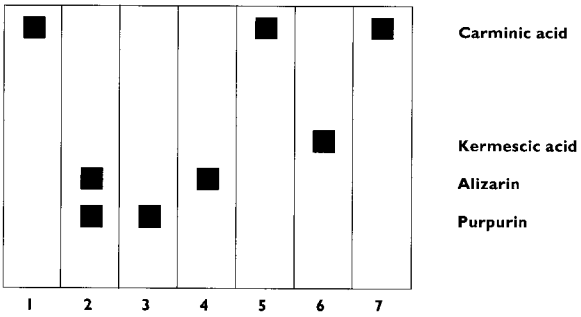
Yellow lake pigments were present in F 555 (*The Pink Orchard*) and F 404 (*Peach Trees in Blossom*). They were not, however, investigated as systematically as the red ones. In *The Pink Orchard* a yellow lake was used in the grass, but the limited sample size made further identification impossible. However, an interesting mixture was discovered in the ground layer, where a weld lake was mixed with a synthetic yellow lake and a red lake (carmine). The same mixture was identified in the field beneath the trees in the painting *Peach Trees in Blossom*. As with the red lakes, the lightfastness of the yellow lakes is very low, with the result that the colours have faded almost to white in many places where these pigments were used (*fig. 20*).

SURFACE LAYERS

These layers were of a complex composition. In addition to egg white,[17] oil, wax, rye flour and polyvinyl acetate were identified. These materials are remnants of former conservation treatments.

Egg white was found in the surface layer of *Peach Trees in Blossom* (F 404), together with wax and rye flour. The presence of the latter two substances is due to an earlier relining.[18] The composition of a polyvinyl acetate from *The Pink Orchard* (F 555) was analysed. The documentation later provided by the restorer mentions that the painting was relined with a type of polyvinyl acetate.[19] All these investigations were carried out by means of Fourier transform infrared spectroscopy (*fig. 21-24*).[20]

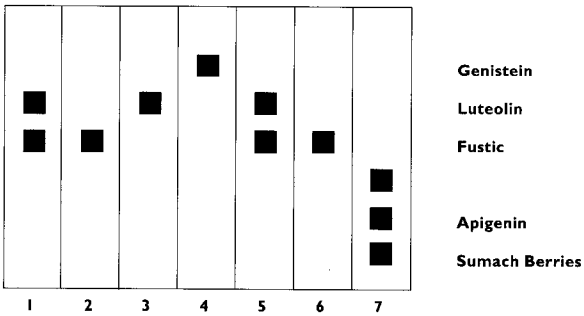
THIN LAYER CHROMATOGRAM OF NATURAL ORGANIC DYESTUFF
Organic reds dyestuffs
Absorbent: Polygram cel 300 AC-10
Solvent: Tetrahydrofuran/ethylacetate/water/35 : 6 : 47/
Detection: Alcoholic potassium hydroxide 0,5 N
Observing in ultra violet light 366 nm



1 = Sample no 25
2 = Madder
3 = Purpurin
4 = Alizarin
5 = Sampl no 44
6 = Kermesic acid
7 = Carminic acid

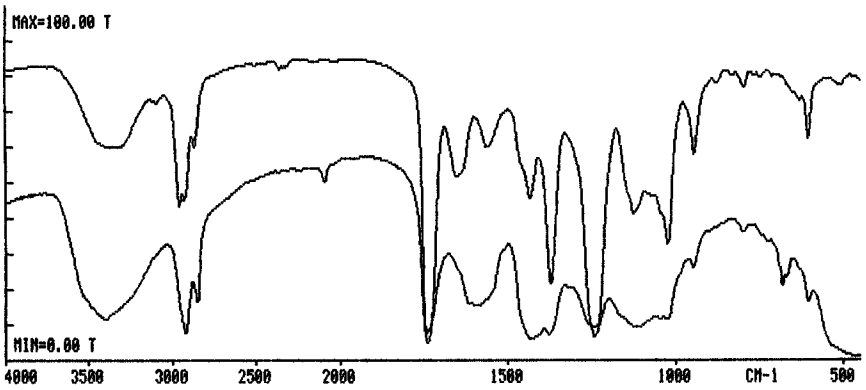
19. Thin-layer chromatogram of organic red dyestuffs.

Organic yellow dyestuffs
Absorbent: Nanosil-Plate SIL-20
Solvent: Chloroform/ethyl acetate/methyl ethyl ketone/formic acid/30 : 5 : 3 : 1
Detergent: Naturstoffreagens A (fluka 2-aminoethyl diphenylborate)
Observing in ultra violet light 366 nm



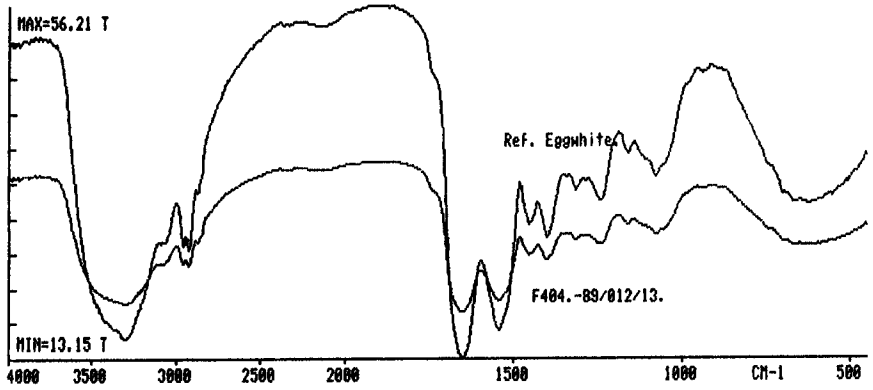
1 = Sample no 25
2 = Apigenin
3 = Luteolin
4 = Genistein
5 = Sampl no 44
6 = Fustic
7 = Sumach berries

20. Thin-layer chromatogram of organic yellow dyestuffs.

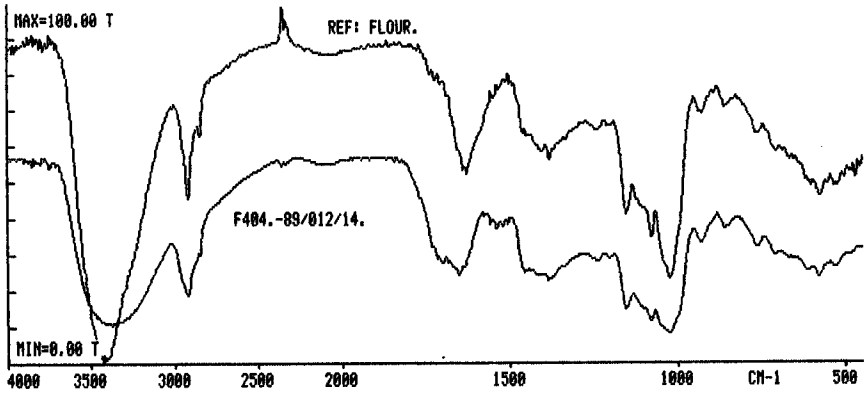


21. FTIR spectrum of an entire sample from The Pink Orchard (F 555), revealing the presence of PVA. Reference spectrum: polymer mixture of polyvinylacetate and a small amount of cellulose nitrate.

22. FTIR spectrum of an entire sample (F 404/13) from the surface coatings of *Peach Trees in Blossom*, identifying the presence of oil, wax, rye flour and egg white.



23. FTIR spectrum of a sample extracted from F 404/13, demonstrating the presence of egg white. Reference spectrum: egg white.



24. FTIR spectrum of a sample extracted from F 404/14, demonstrating the presence of rye flour. Reference spectrum: rye flour.

NOTES

The scientific investigations were carried out by M.F.S. Karreman (Fourier transform infrared spectroscopy), M. de Keijzer (microscopy and laser microprobe analysis), W.G.T. Roelofs (thin-layer chromatography) and J.H. Hofenk de Graaff (coordination and compilation).

1. The staining tests at the Central Laboratory were carried out in accordance with the methods described in M. Johnson and E. Packard, 'Methods Used for the Identification of Binding Media in Italian Paintings of the Fifteenth and Sixteenth Centuries', *Studies in Conservation* 16 (1971), pp. 145-64, and E. Martin, 'Some Improvements in Techniques of Analysis of Paint Media', *Studies in Conservation* 22 (1977), pp. 63-67. The cross-sections are observed by BG 12 excitation, and by 530 nm suppression.

2. The x-ray diffraction analyses were carried out at the Central Laboratory by P.B. Hallebeek.

3. The information from the laboratory is interpreted in the contribution by Mette Maria Bang.

4. Cf. P. Cadorin, M. Veillon and B. Mühlethaler, 'Décoloration dans la couche picturale de certains tableaux de Vincent van Gogh et de Paul Gauguin', ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, pp. 267-73; B.L. Engel, *A Study of the Materials and Techniques Used by Vincent van Gogh*, unpublished manuscript, Intermuseum Laboratory, Oberlin 1975; E. Farrell and R. Newman, 'Van Gogh's Painting Materials: an Analysis of the *Self-Portrait Dedicated to Paul Gauguin* and Other Arles Period Paintings', in Jirat-Wasiutyński *et al.*, p. 34; J. Leighton, A. Reeve, A. Roy and R. White, 'Vincent van Gogh's "A Cornfield with Cypresses"', *National Gallery Technical Bulletin* 11 (1987), pp. 42-60; R.D. Harley, 'A Nineteenth-Century Book of Color Samples', *Bulletin of the* AIC 15, no. 2 (1975), pp. 49-54; H. Kühn, 'Die Technik der Farbenherstellung in der Neuzeit', *Maltechnik/Restauro* 88 (1982), pp. 35-45; H. Pohl, *Die chemische Industrie in den Rheinlanden während der industriellen Revolution*, vol. 1, *Die Farbenindustrie*, Wiesbaden 1983; E.L. Richter and H.A. Harlin, 'A Nineteenth-Century Collection of Pigments and Painting Materials', *Studies in Conservation* 19 (1974), pp. 76-82.

5. See J.H. Hofenk de Graaff and W.G.T. Roelofs, 'On the Occurrence of Red Dyestuffs in Textile Materials from the Period 1450-1600', ICOM *Committee for Conservation*, 3rd Triennial Meeting, Madrid 1972.

6. T.W. Goodwin, *Chemistry and Biochemistry of Plant Pigments*, vol. 2, London 1976; R.W.D. Harrison, *The Manufacture of Lakes and Precipitated Pigments*, London 1957; A.G. Perkin and A.E. Everest, *The Natural Organic Colouring Matters*, New York 1918, pp. 623-29; J. Stössel, *Rote Farblacke in der Malerei; Herstellung und Verwendung im deutschsprachigen Raum zwischen ca 1400 und 1850*, Institut für Technologie der Malerei der Staatliche Akademie der Bildende Kunsten, Stuttgart 1985, pp. 459-62; R.H. Thomson, *Naturally Occurring Quinones*, London 1971; J.H. Hofenk de Graaff, 'Natural Dyestuffs: Origin, Chemical Constitution, Identification', ICOM *Committee for Conservation, 2nd Triennial Meeting*, Amsterdam 1969; H. Schweppe and H. Roosen-Runge, 'Carmine-Cochineal, Carmine and Kermes Carmine', in R.L. Feller (ed.), *Artists' Pigments: a Handbook of Their History and Characteristics*, Cambridge etc. 1986, pp. 255-83.

7. See Hofenk de Graaff, op. cit. (note 6).

8. H. Kittel, *Pigmente*, Stuttgart 1960; S. Mierzinsky, *Die Erd-, Mineral und Lackfarben*, Weimar 1981, pp. 411-13; A. Eibner, *Materialenkunde als Grundlage der Maltechnik*, Berlin 1909, pp. 206-07.

9. G.A. Buchheister, *Handbuch der Drogisten-Praxis: ein Lehr- und Nachschlagbuch für Drogisten, Farbwarenhändler etc.*, Berlin 1893, pp. 668-69.

10. J. Bersch, *Die Fabrikation der Mineral- und Lackfarben*, 2 vols., Vienna 1893, vol. 2, pp. 465-510.

11. M. Crace-Calvert, *Traité de la teinture des tissus et de l'impression du calicot*, Paris 1877-78.

12. See Bersch, op. cit. (note 10).

13. Ibid., vol. 2, p. 495.

14. The analyses were carried out by Eugena Ordonez at the museum's laboratory. Some cross-sections of *The Pink Orchard* were observed with the scanning electron microscope and analysed with EDX.

15. See H. Kühn, H. Roosen-Runge, R.E. Straub and M. Koller, *Reclams Handbuch der künstlerischen Techniken*, vol. 1, Stuttgart 1984; R.D. Harley, *Artists' Pigments 1600-1835*, London 1982; R.J. Gettens and G.L. Stout, *Painting Materials*, New York 1966.

16. A fairly extensive investigation was launched to find a proper analytical system for identifying the early synthetic dyestuffs and pigments by means of thin-layer chromatography. It focused on the absorbents and the eluents as mentioned in I. Strauss, 'Übersicht über synthetisch organische Künstlerpigmente und Möglichkeiten ihrer Identifizierung', *Maltechnik/Restauro* 90 (1984), pp. 22-44, esp. pp. 40-41, and the adsorbents and eluents for natural dyestuffs (see note 3). A number of synthetic dyestuffs and pigments dating from 1870-90 were analysed. They were Martius Yellow (Gahnal, 1856), Naphthol Yellow (H. Caro, 1879), Croceïne Orange G (P. Griess, 1878), Ponceau 3 RO (C. Rumpff, 1882), Ponceau G (H. Baum, 1878), Ponceau RR (H. Baum, 1878), Fast Red B (H. Baum, 1878), Magenta (Natanson, 1856), Methyl Violet (Lauth, 1861), Rhodamine B (Ceresole, 1887), Eosine A (H. Caro, 1871), Safranine T (Greville Williams, 1859), Alizarin (synthetic, C. Greabe and C. Liebermann), Alizarin Red S (C. Greabe and C. Liebermann), Alizarin Red PS and Alizarin Red SS (M.L.B.), together with madder and carmine. The samples were kindly supplied by Dr H. Schweppe.

The investigation is not yet complete, because some of the requisite reference material is still not available, but it will be continued and published at a later date. The research is being carried out by W.G.T. Roelofs at the Central Research Laboratory, Amsterdam, with the practical assistance of W. Salburg, chemistry trainee.

17. See the contribution by Cornelia Peres, 'On Egg-White Coatings', and the staining tests by Carol Stringari, and *fig. 22-23*, showing the FTIR results of the analysis of egg white in *Peach Trees in Blossom*.

18. See also the contribution by Carol Stringari.

19. The polyvinyl acetate, trade name TT 79, is mentioned in the documentation by J. Van Beek, former conservator at the Stedelijk Museum in Amsterdam, where the painting was treated in the early 1970s. The exact recipe was given by the supplier. See also the contribution by Carol Stringari, p. 66, note 35.

20. A number of samples were also taken to identify problems relating to the binding media. The analyses were done with FTIR, and the results have been incorporated in the text above.

The Pink Orchard (F 555)

Sample no.	Description	Colour,[1] layers	LMA[2]	FTIR	TLC	Pigment identification[3]
F 555/1	Blue tree left, discoloured and crumbled red	Red, thin top section faded Fluorescence red: red, faded red: green	Sn, Ca, (Al), Mg	Oil, wax	Carminic acid	Carmine, aluminium/tin-lake, precipitated on chalk
F 555/2 (fig. XLIII)	Light pink blossom, top faded	1. Light green 2. Orange 3. Light red, top faded 4. Thin transparent layer			Carminic acid	Carmine
F 555/3 (fig. XLIV)	Branch right upper edge,	1. Yellow green 2. Red unfaded red	Cu, Zn, Ca, Al, Hg, Pb, Mg	Carmine, wax	Carminic acid	1. Emerald green, white lead,zinc white, yellow pigment (not identified) 2. Carmine, aluminium lake precipitated on chalk, vermilion
F 555/5 (fig. XLV)	Green and white, leaches after solvent treatment	1. Pink/red 2. Green	Zn, Ca, Pb, (Co), Mg			1. Red lake 2. Lead white, zinc white, cobalt green,[4] chalk.
F 555/6	Green in grass, turns brownish at the surface	Green		Chrome yellow, Prussian blue	Yellow synthetic organic dyestuff	Chrome yellow ($PbCrO_4$·$PbSO_4$), Prussian blue, yellow synthetic organic lake
F 555/7	Yellow in grass, soluble	Yellow		Lead white, chrome yellow, gypsum	Yellow synthetic organic dyestuff	Lead white, chrome yellow ($PbCrO_4$), synthetic organic lake (same as in sample F 555/6) precipitated on gypsum
F 555/8	Red from strokes in the grass, stays soft, soluble	Red		Carmine (cochineal)	Carminic acid	Carmine
F 555/9	Light blue, crumbled	1. Light green 2. Varnish	Zn, Ca, Pb, (Mg)			1. Lead white, zinc white, cobalt green,[4] chalk
F 555/10	Dark red from tree branch, very soluble, bleeding	Dark red		Carmine	Carminic acid	Carmine, aluminium lake

1. From ground to surface.
2. Weaker emission lines from minor components are given in brackets.
3. The pigments were identified by spectrographic analyses (FTIR, LMA), thin-layer chromatography (TLC) and X-ray diffraction. Where no method is specified an optical microscope was used.
4. X-ray diffraction.

The Pink Orchard (F 555)

Sample no.	Description	Colour,[1] layers	LMA[2]	FTIR	TLC	Pigment identification[3]
F 555/11	Sky	1. White with greenpigment particles 2. light blue	Zn, (Ca), Pb, Cr Zn, (Pb)			1. Lead white, zinc white, viridian 2. Zinc white, (white lead), Prussian blue
F 555/12	Ground, (pink), medium? filler?	Transparent white/pink		Lithopone, egg yolk	Carminic acid, luteolin, apigenin, yellow organic synthetic dyestuff	Lithopone, carmine, aluminiumlake of weld, yellow organic synthetic lake (same as in samples F 555/6 and 7) gypsum, zinc white, lithopone[5]

5. Energy-dispersive X-ray microanalyses (EDX), carried out by Eugena Ordonez at the Museum of Modern Art, New York.

Peach Trees in Blossom (F 404)

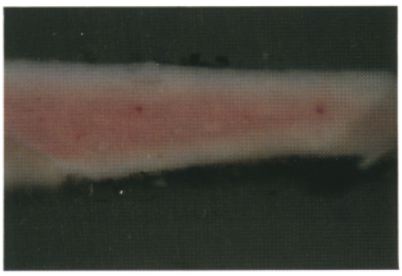
Sample no.	Description	Colour, layers	LMA	FTIR	TLC	Pigment identification
F 404/1	Surface layer			Oil, wax, flour, egg white	No component	
F 404/2	Varnish layer and grey layer from middle part of the tree			Wax, flour, egg white		
F 404/3	Light blue in tree, pink underneath	Blended layer (light blue, slightly pink)	Pb, (Ca)	Lead white, Prussian blue	No component	Lead white (Prussian blue)
F 404/4	White blossom in tree, pink underneath	White with a pink swirl outer part faded	Pb, (Mg), Ca, Al	Lead white, chalk	Carminic acid	Lead white, carmine aluminium lake, precipitated on chalk
F 404/5	Yellowish white in tree, middle right	Light yellow, faded at the top	(Ca), (Al), Pb, (Mg), Cr	Lead white, chalk, chrome yellow	Yellow organic synthetic dyestuff	Lead white, chrome yellow ($PbCrO_4$), yellow organic synthetic lake precipitated on chalk
F 404/6	Blossom in tree light rose, pink underneath	Pink		Lead white, cochineal	Carminic acid	Lead white, carmine, aluminium lake.
F 404/7	Blossom in tree, whitish beige	1. White 2. Varnish Fluorescence: white: strong green	Ca, Pb			Lead white, chalk

Peach Trees in Blossom (F 404)

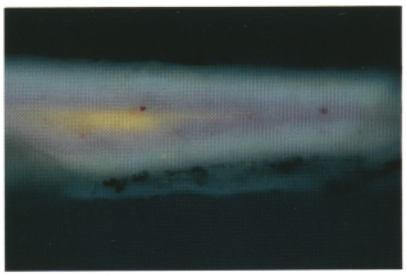
Sample no.	Description	Colour, layers	LMA	FTIR	TLC	Pigment identification
F 404/8	Sky, light blue	Light blue, no blue pigment particles, few green particles	(Ca), Pb, Cr			Lead white, (Prussian blue), (viridian)
F 404/9	Greenish light blue in sky	Light blue, no blue pigment particles, few green particles	(Ca), Pb, Cr			Lead white, (Prussian blue), (viridian)
F 404/10 (fig. XLVI)	Pale brown grey in the field, pink underneath	1. Pink 2. Green-yellow	Ca, Pb, Cr	Lead white, chalk	Too small	1. Lead white, chalk 2. Chrome yellow
F 404/11	White in the field pink underneath	Pink		Lead white, chalk	Carminic acid, luteolin, apigenin, yellow synthetic organic dyestuff (same combination as in F 555/12)	Lead white, carmine aluminium lake precipitated on chalk, weld lake on chalk, yellow synthetic organic lake
F 404/12	Greenish white in the field, light pink underneath	1. White, some yellow and red particles 2. Light green	(Ca), Pb (Ca), Pb			1. Lead white, chalk 2. Lead white, chalk
F 404/13 (fig. XLIX)	Light greenish blue in the field, right edge of the painting	1. White ground 2. Blend of red, blue, yellow, white 3. Light green.	Ca, Pb (Ca), Pb, (Mg) (Ca), Pb, Cr			1. Lead white, chalk 2. Lead white, chalk (chrome yellow?), (viridian?), (carmine?), (Prussian blue?) 3. Lead white, viridian
F 404/14 (fig. XLVIII)	Discoloured pink in the field, from bottom of painting	Pink, orange Fluorescence pink: yellow/green orange: reddish	Ca, (Al), Pb, Cr, Mg	Lead white	Carminic acid, red synthetic organic dyestuff	Lead white, chrome orange, carmine aluminium lake precipitated on chalk, geranium (eosine) lake (?), (vermilion)
F 404/15	Discoloured light pink in the field, lower edge	Pink, upper part faded.Fluorescence pink: yellow/green faded part: green	Ca, Al, Pb	Lead white	Carminic acid, red synthetic organic dyestuff	Lead white, carmine aluminium lake, precipitated on chalk, geranium (eosine) lake (?), (vermilion)
F 404/16 (fig. XLVII)	Orange dot in the field, left edge	1. Orange, outer part faded 2. Varnish	Ca, (Hg), Pb	Lead white, eosine, vermilion	Eosine	Lead white, geranium (eosine) lake, vermilion

The White Orchard (F 403)

Sample no.	Description	Colour, layers	LMA	FTIR	TLC	Pigment identification
F 403/4	Light yellow from branch of tree	Semi-transparent, slightly yellow		Lead white, chrome yellow, Prussian blue	No component	Lead white, (chrome yellow), (Prussian blue)
F 403/5	Light green from upper right edge	1. White ground 2. Thin orange layer 3. yellow	(Ca), Pb,(Mg), Cr			Lead white, chrome yellow, viridian, (chalk)
F 403/8	Light blue from centre right of the tree	Blend of white green, yellow, blue and pink pigments	(Ca), Pb, Cr, Cu			Lead white, chalk, chrome yellow, (viridian), (emerald green), (red lake?) (ultramarine?)
F 403/9	Muddy brown from lefthand tree	Yellow layer with green pigment particles, some red particles (1), left side faded to white with green particles (2)	Cu, Ca, Pb, (Mg), Cr (Ca),Pb			1. Lead white, chalk, chrome yellow, (viridian), (emerald green?) 2. Lead white, chalk
F 403/10	Brownish red branch, centre left, soluble, bleeding	Violet red, brownish red at the surface		Madder?	Carminic acid	Carmine
F 403/11	Dark blue with brown from branch of tree in the centre, soluble, bleeding	Dark greenish blue, lower part brownish		Lead white, Prussian blue, emerald green		Lead white, Prussian blue, emerald green
F 403/12	Dark blue from branch of tree, soluble, bleeding	Dark greenish blue (as in sample F 403/11)		Lead white, Prussian blue		Lead white, Prussian blue

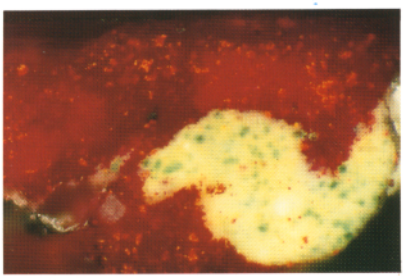


XLI *White Orchard* sample 403/3, showing discoloured carmine below the surface. Cross-section, 20 x.

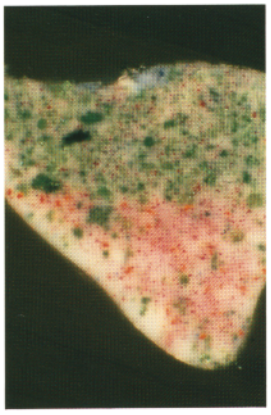


XLII *White Orchard* sample 403/3. The yellow fluorescence in the centre reveals that a different lake was mixed with the carmine. Cross-section in UV light, 20 x.

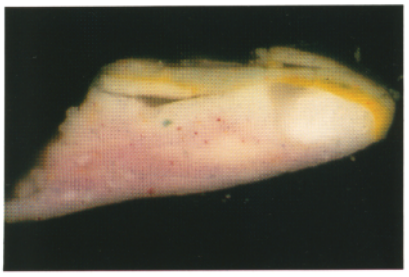
XLIII Sample F 555/2
– Brownish transparent coating
– White pigment mixed with carmine, upper part shows fading of pink paint layer
– Orange lake
– White pigment mixed with Prussian blue and green
– Ground layer.



XLIV Sample F 555/3
– Light yellow with emerald green, small amounts of carmine and zinc white
– Carmine mixed with a little vermilion.

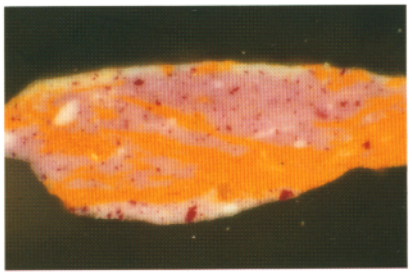


XLV Sample F 555/5
– A tiny amount of blue pigment
– Cobalt green, zinc white, lead white and some organic red particles
– Carmine with a little vermilion.

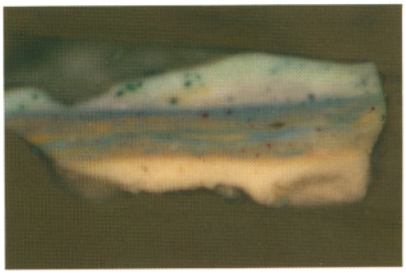


XLVI Sample F 404/10
– Chrome yellow, lead white, chalk
– Pink (carmine with lead white).

XLVII Sample F 404/16
– Mainly eosine with small amounts of vermilion. The orange lake is faded immediately below the surface.



XLVIII Sample F 404/14
– Lead white , chrome orange, carmine, orange lake (eosine?), vermilion. The purplish pink is faded immediately below the surface.



XLIX Sample F 404/13
– Lead white, viridian
– Lead white, chrome yellow (?), viridian (?), Prussian blue, carmine, small amounts of vermilion (?)
– Lead white, chalk.

GAUGUIN'S PORTRAIT OF VAN GOGH PAINTING SUNFLOWERS

Introduction

Paul Gauguin's *Portrait of Vincent van Gogh Painting Sunflowers* of 1888 had not been on display for several years because deterioration of the jute support, aggravated by a recent conservation treatment, made it too fragile to support the tension of hanging on the museum wall. In May 1987 an informal committee of experts met to discuss how the painting could be treated so that it could be returned to permanent display in the Van Gogh Museum. The committee consisted of Ronald de Leeuw, director of the museum; Han van Crimpen, Curator of Collections; Jan Diepraam, private conservator; Cornelia Peres, the museum's Conservator of Paintings; Travers Newton, private conservator; and Vojtěch Jirat-Wasiutyński, Associate Professor of Art History, Queen's University, Kingston, Ontario, Canada. Their findings were reported separately after the meeting.

The committee recognised that an adequate solution would depend on the fullest possible understanding of the materials, techniques and aesthetic of the painting, and that additional time would be needed to carry out the necessary technical examination, scientific analysis and historical documentation. The museum agreed to invite Travers Newton to work for one month in its conservation laboratory as a guest conservator, so that thorough technical research could be conducted jointly. The plan was realised in June 1988. The Scientific Department of the National Gallery of Art, London (Ashok Roy, Raymond White) and the Central Research Laboratory for Objects of Art and Science, Amsterdam, did the requisite analyses and tests, coordinated by Judith Hofenk de Graaff.

Vojtěch Jirat-Wasiutyński, consultant historian to the project, had previously researched the technique of the painting as part of a decade-long research project with Travers Newton on Gauguin's method, materials and preparatory procedures. Because of the cross-pollination, the following essays are in fact a collaborative effort. In principle, however, Jirat-Wasiutyński was responsible for the historical section and general editing, Newton for the section on technique, and Peres for the restoration report.

1 Paul Gauguin, *Portrait of Vincent van Gogh Painting Sunflowers*, 1888, 73 x 91 cm. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

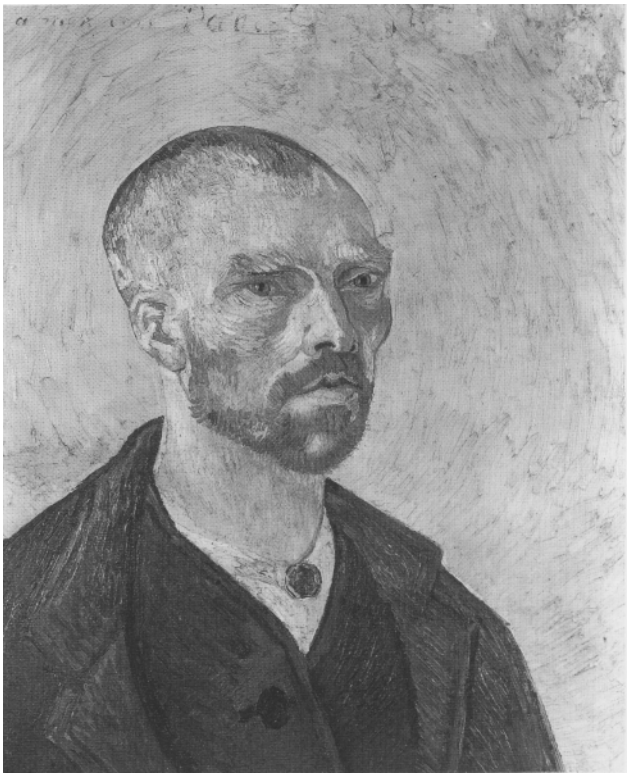
Painting from Nature versus Painting from Memory

Vojtěch Jirat-Wasiutyński

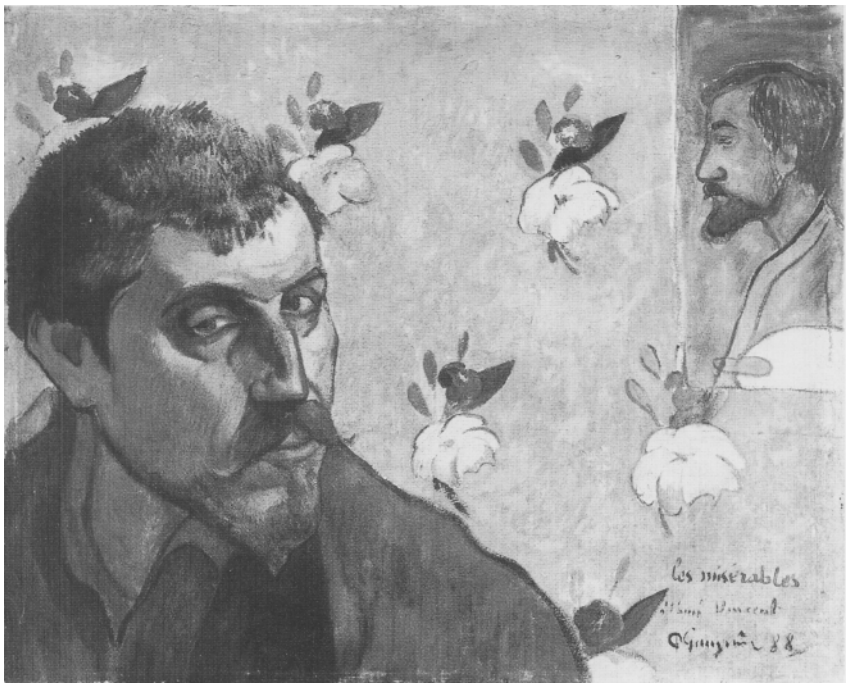
Paul Gauguin painted his *Portrait of Vincent van Gogh Painting Sunflowers* in early December 1888 in Arles (fig. 1, p. 89). He had joined Vincent on 23 October, travelling overnight by train from Pont-Aven in Brittany.[1] In late June, Gauguin had agreed to live and work with Vincent in Arles while being supported by a monthly stipend from his brother Theo, who worked in Paris for the Montmartre gallery of Boussod, Valadon et Cie. Gauguin received 150 francs a month and promised to complete one painting in that time.[2] He was, however, detained in Pont-Aven by debts and poor health, and the arrival of the painter Émile Bernard in mid-August and the artistic exchange that followed, further delayed his departure for the south. That summer Vincent van Gogh had maintained an active correspondence with both men, and played an important role in bringing them together once again in Pont-Aven.[3] The support of contemporary artists and their collaboration in regional studios were two of Vincent's cherished ideals. Gauguin's move to Arles, to head the 'Studio of the South', was to be an important step in realising these aims. Bernard and other artists might also participate in the future.[4]

While impatiently awaiting Gauguin's departure, Van Gogh asked his colleagues to paint each other's portraits as a tangible record of their collaboration in Pont-Aven and to send them to him in Arles as part of an exchange of paintings. As it turned out, the three artists all produced self-portraits early in September. Vincent naturally painted a self-portrait (*fig. 1*), which he dedicated to Gauguin, since he was working alone.[5] Gauguin and Bernard decided not to do each other's portraits, perhaps because the younger artist felt that he 'could not' [539]. Each included an image of the other in the self-portrait in the form of a self-portrait drawing by the other displayed on the wall (*figs. 2-3*). Vincent van Gogh seems to have found it no easier to portray Gauguin, once he had moved to Arles, than Bernard had done in Pont-Aven. His *Gauguin's Chair* functions as a substitute portrait, with its pendant, *Van Gogh's Chair* being a self-portrait (*figs. 4-5*). Gauguin did, however, portray Vincent. The *Portrait of Vincent van Gogh Painting Sunflowers* continues the series of artists' portraits begun in Pont-Aven.

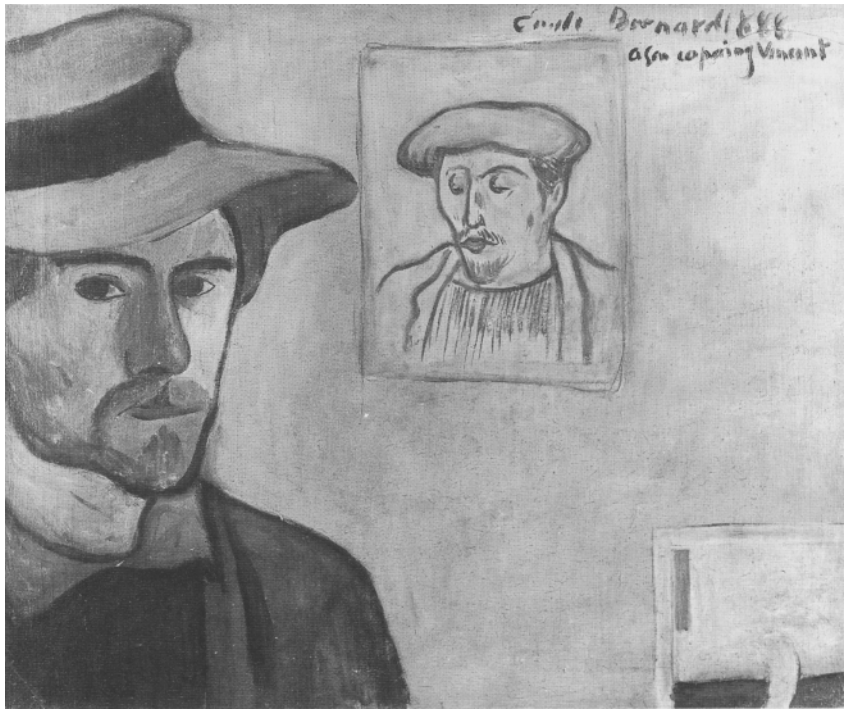
Vincent van Gogh reported the portrait as 'in progress' in a letter to Theo about 4 December. With characteristic reticence where his own person was concerned, he wrote: 'he is working on a portrait of me which I do not count among his useless undertakings' [560]. It was sent to Theo in Paris about 20 December. In the letter telling him of the shipment, Gauguin presented the portrait to Theo as 'quel-



1. Vincent van Gogh, *Self-Portrait as Bonze*, 1888. Cambridge (Mass.), Fogg Art Museum (Harvard University Art Museums).



2. Paul Gauguin, *Self-Portrait with Portrait of Bernard, 'Les Misérables'*, 1888. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

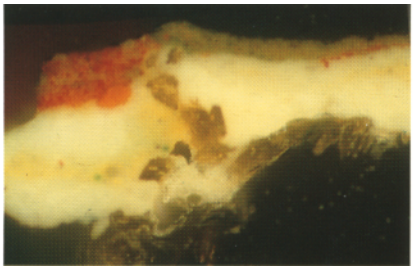


3. Émile Bernard, *Self-Portrait with Portrait of Gauguin*, 1888. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

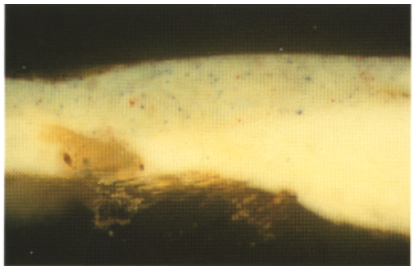
II *Portrait of Vincent van Gogh Painting Sunflowers*, transmitted light photograph.

III *Portrait of Vincent van Gogh Painting Sunflowers*, UV photograph.

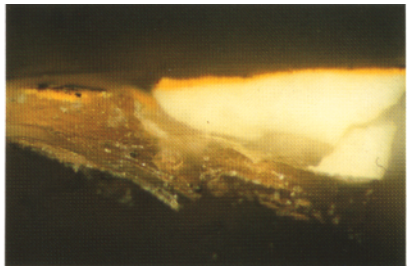
IV Cross-sections of Gauguin's *Portrait of Vincent van Gogh Painting Sunflowers* (see also *fig. 17*, on p. 108).



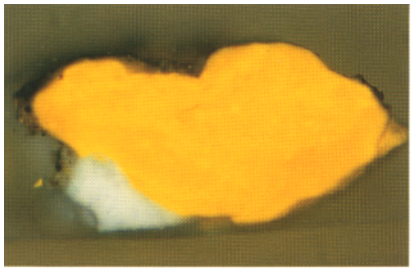
a – Greenish layer
(mixture of chrome yellow, synthetic ultramarine and vermilion)
– Thin layer of vermilion
– Lead-white ground.



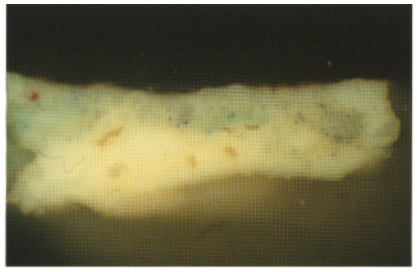
b – Synthetic ultramarine, with traces of vermilion particles
– Lead-white ground.



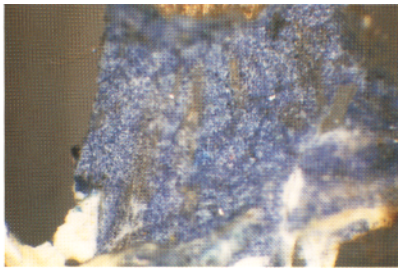
c – Lead chrome yellow
– Lead-white ground.



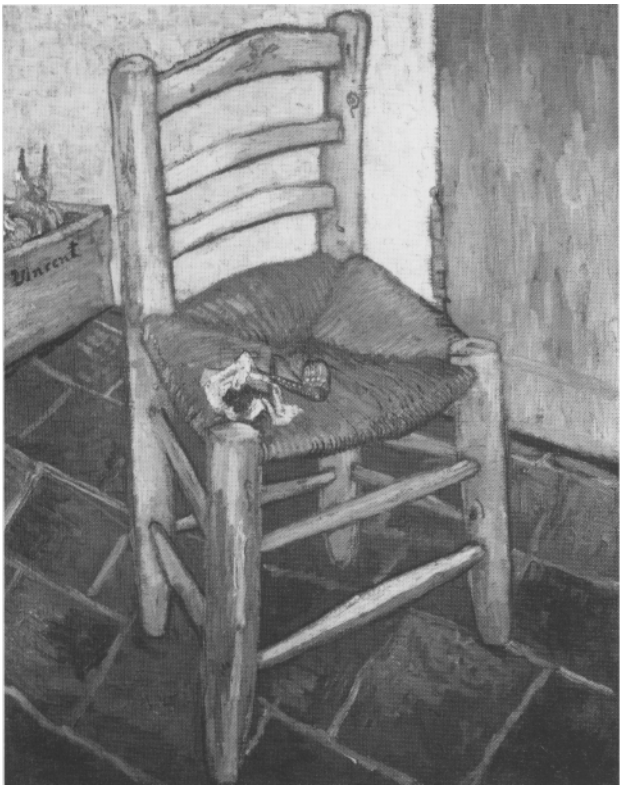
d – Thick lead chrome yellow
– Synthetic ultramarine blue
– Lead-white ground.



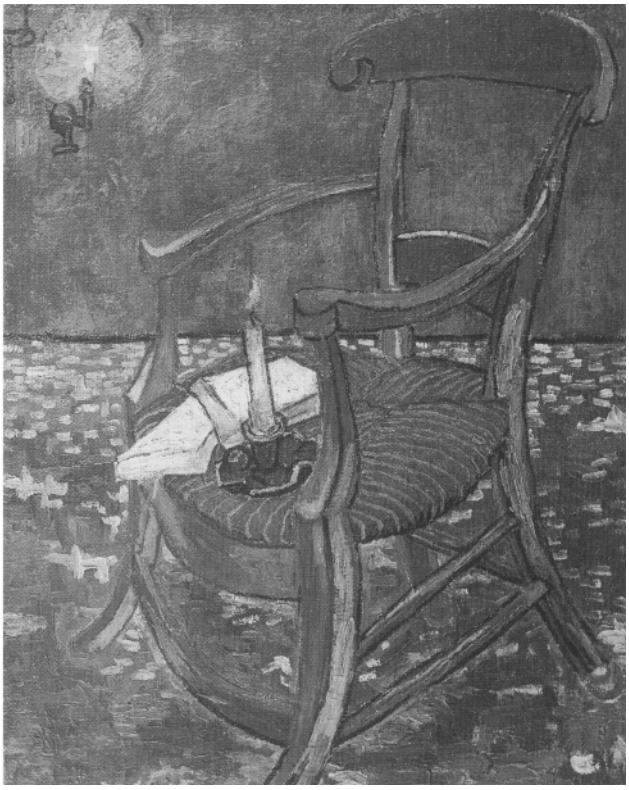
e – Mixture of copper green (Scheele's or Schweinfurt green) with chrome yellow and synthetic ultramarine
– Lead-white ground.



f – Synthetic ultramarine with just a trace of green pigment, probably emerald green, and red ochre.



4. Vincent van Gogh, *Van Gogh's Chair*, 1888. London, The Trustees of the National Gallery.



5. Vincent van Gogh, *Gauguin's Chair*, 1888. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

quechose d'intime de lui', an image of Vincent as 'le peintre des tournesols'.[6] It is quite clear that Gauguin's intentions for the portrait changed with the changing circumstances in Arles. But whom was Gauguin addressing in the portrait in the first place, the painter/colleague Vincent or the dealer/patron Theo van Gogh, who was also an invisible collaborator in this artists' community?

Between the start of the painting and its shipment to Paris, a violent disagreement had decided Gauguin to leave Arles; but realising Van Gogh's need of him, he had reconsidered and a reconciliation had taken place, celebrated by a visit to the Musée Fabre, including the Bruyas Collection, in Montpellier.[7] It was only after these events that Gauguin dispatched the *Portrait of Vincent van Gogh Painting Sunflowers* and wrote the letter cited. Theo van Gogh presumably received the painting shortly after 20 December, but his reaction has not been recorded. This is not surprising, for on 24 December he was summoned to Arles by Gauguin's telegram advising him of Vincent's self-mutilation the previous night.[8]

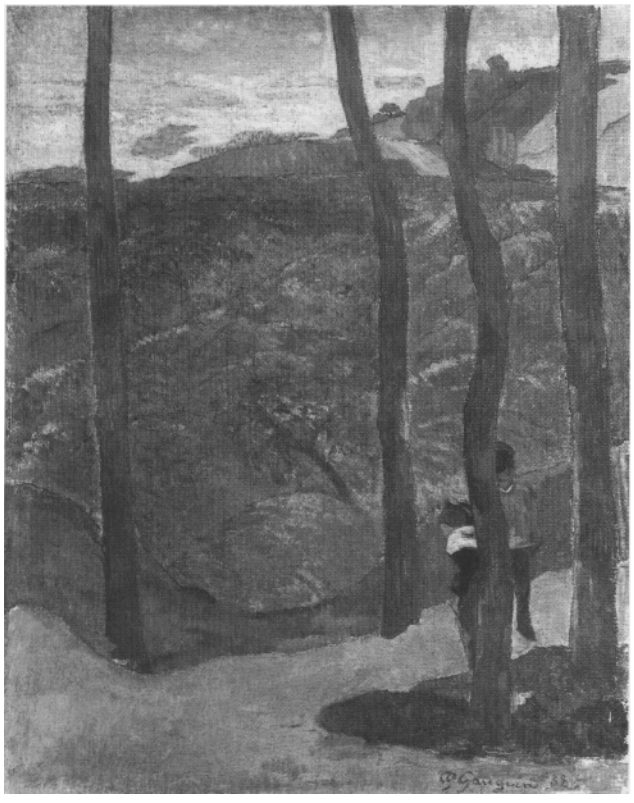
The two texts cited above are the only references to the painting at the time of its production in Arles in December 1888. On 10 September 1889, almost a year later, Vincent van Gogh commented on the portrait in a letter to Theo from Saint-Rémy; at the time, he was considering returning north and thought of Gauguin in Brittany. He wrote that he was 'still hoping to do his portrait,' although he was 'a little afraid of Pont-Aven.' 'Have you seen that portrait that he did of me, painting some sunflowers?' he asked. 'Afterward my face got much brighter, but it was really me, very tired and charged with electricity as I was then' [605]. This was, of course, a retrospective assessment of the days shared with Gauguin in the studio in Arles.

Finally, at the end of his life in the South Pacific, Gauguin inserted the *Portrait of Vincent van Gogh Painting Sunflowers* and the subject's supposed reaction to it into his antimemoirs called *Avant et après*. Here Vincent is made to say, 'it is I, but I gone mad'.[9] The painting had now become part of Gauguin's legendary and distorted firsthand account of the two artists' sojourn and interaction in the 'Yellow

House' in Arles, which was seen as culminating in Van Gogh's first serious 'attack of madness'. There is some implication, too, that the portrait was to blame in so far as, because of the painter's acuity, it foretold Vincent's madness.

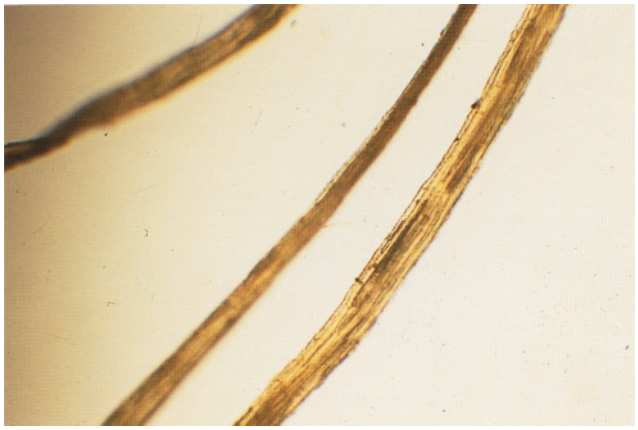
There is scant documentary evidence for interpreting the *Portrait of Vincent van Gogh Painting Sunflowers* which is contemporary with the painting, and almost from start it shows the image being manipulated for psychological reasons by author and subject. Clearly a significant interpretative shift took place between Gauguin's presentation of the portrait to Theo in 1888 and his last, to posterity in 1903. Nor do we know what his intentions may have been at the moment of creating the image. Van Gogh, as the sitter, initially regarded the portrait as worthwhile, but soon associated it with the tense mental state preceding his breakdown in December 1888. While even the earliest interpretations of it change, the painted image itself shows no evidence of major changes having occurred after the moment of its visualisation in sketches or in the course of its execution. We can come closer to its original meaning for Gauguin by establishing a first, pre-iconographic analysis of what we see and, then, by placing this image fully in the reconstructed context of its production.

As noted, Gauguin joined Van Gogh in Arles on 23 October, and about six weeks later he was at work on the portrait. In the image, Van Gogh is shown painting sunflowers, some of which have gone to seed; they are placed in a ceramic vase on a chair. He is seated before a small travelling easel; this is the easel of an outdoor artist, as opposed to a heavy studio easel with a crank. The painting is tilted backwards at about 70° from the vertical; it is not clear whether the canvas is attached to a stretcher or nailed to a board. Van Gogh holds a rectangular palette and a medium-sized brush. Behind him, on the wall, hangs an unframed landscape painting in Gauguin's contemporary style; it resembles such works as the *Blue Trees* (*fig. 6*), which was painted at Arles in November.[10] Van Gogh is portrayed at work in the studio of the 'Yellow House', as can be seen from the bluish-white walls found, for instance, in Van Gogh's *Bedroom at Arles* (Amsterdam, Rijksmuseum Vincent van Gogh) and from the rush seat of the chair resembling the type shown in *Van Gogh's Chair*, which furnished the



6. Paul Gauguin, *Blue Trees*, 1888. Copenhagen, The Ordrupgaard Collection.

7. Vincent van Gogh, *Still Life with Sunflowers*, 1888. Munich, Neue Pinakothek, Bayerische Staatsgemäldesammlungen.



v Jute canvas fibre of the *Portrait of Vincent van Gogh Painting Sunflowers*, 125 x.

vi *Portrait of Vincent van Gogh Painting Sunflowers*, detail showing horizontally broken canvas threads along the upper edge of the painting, 16 x.

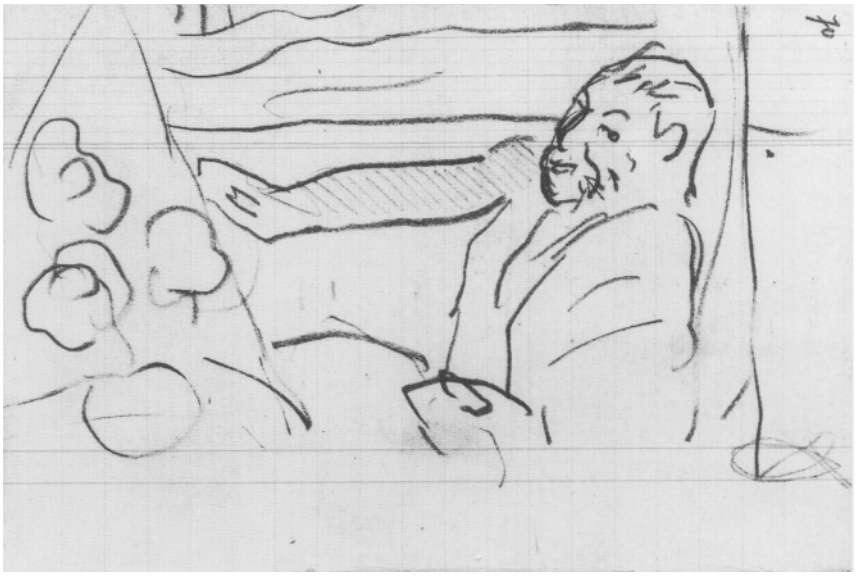
vii *Portrait of Vincent van Gogh Painting Sunflowers*, detail showing tiny cracks and tears caused by the tensions in the canvas, 16 x.

viii Matt greyish surface, due partly to the alterated coating and partly to surface dirt.

8. Paul Gauguin, *Sketchbook*, 1888-89, p. 41. Jerusalem, Israel Museum.

house. Gauguin chose a high viewpoint, as though he were standing above the scene recording it, and exaggerated the foreground perspective so that the viewer has the feeling of being close up to the artist at work.[11]

Gauguin certainly saw Van Gogh painting in the studio many times. This particular scene, however, is an imagined one, which he could not have witnessed as such but must have constructed from a variety of sources. Van Gogh painted the Arlesian sunflowers in August and they were certainly past by September, so that Gauguin could not have seen him painting them.[12] Moreover, the flower arrangement corresponds to none of the August versions; nor to any from 1887 or 1889 for that matter. The flower still life in the portrait seems closest to the *Still Life with Sunflowers* (*fig. 7*), because of the blue background and the arrangement of the five central flowers in that painting. This was one of the two sunflower paintings which hung in Gauguin's bedroom at Arles.[13] Van Gogh did not use a blue ceramic vase to hold any of the sunflower arrangements; the ceramic vase does, though, resemble one found in several other paint-ings.[14] Nor did he place any of his still lifes on chairs to paint them. That was a device used very early on by Gauguin himself in *Pour faire un bouquet*, 1880 (W 49; Winterthur, Jäggli-Corti Collection), and which he repeated late in life when he too painted sunflowers.[15] There may be another reason for the presence of the chair. Van Gogh was probably painting it for *Van Gogh's Chair* in early December, at the very time when Gauguin was preparing his portrait of him in the same studio.[16]



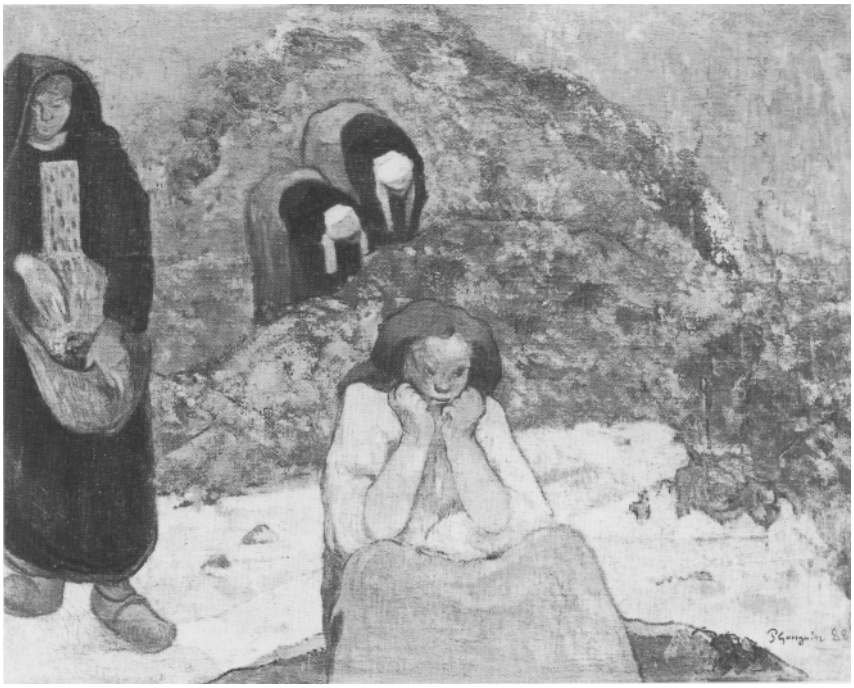
9. Paul Gauguin, *Sketchbook*, 1888-89, p. 70. Jerusalem, Israel Museum.

10. Paul Gauguin, *Among the Mangoes at Martinique*, 1887. Amsterdam, Rijksmuseum Vincent van Gogh (Vincent van Gogh Foundation).

The *Carnet*, a sketchbook used in Arles, contains a page with two sketches from life of Van Gogh's face, which were clearly used as studies for the portrait (*fig. 8*). Details of the face and the thumb inserted through the palette were reworked in a separate sketch in the lower right corner. Here Van Gogh appears to have his left eye open and his right eye closed, as though Gauguin intended to portray him using the draughtsman's trick of closing one eye on the subject in order to measure proportion. There is also a rapid compositional study in a different part of the sketchbook, where the sunflowers and a background landscape are indicated schematically (*fig. 9*). As in the case of several other paintings from Arles, Gauguin probably first developed a general concept of the portrait, which he noted in the compositional sketch, and then studied crucial details from life.[17]

In other words, rather than recording from life a scene that he saw in the studio of the 'Yellow House', Gauguin deliberately set out to invent an image of Van Gogh as the painter of sunflowers, combining observation and visual sources, memory and imagination in the process. He had begun to identify him with those flowers soon after they met in November 1887. At that time, Gauguin acquired two of the sunflower paintings of 1887 in exchange for a Martiniquan landscape with figures.[18] In late August 1888, Vincent van Gogh, aware of course of Gauguin's liking for his sunflowers, immediately designated the new Arlesian series to decorate their joint studio. More specifically, the sunflower paintings were destined to adorn Gauguin's bedroom in the 'Yellow House' and he responded very positively to them upon his arrival.[19] In late November, Vincent van Gogh reported to his brother Theo that Gauguin had told him a few days ago that he preferred his treatment of sunflowers to a painting of the flowers by Claude Monet.[20] This suggests that Gauguin may already have started to plan his *Portrait of Vincent van Gogh Painting Sunflowers*. Despite the modest refusal to agree with Gauguin's ranking of his work above Monet's, Van Gogh clearly accepted the identification as the painter of sunflowers which his colleague bestowed upon him. He wrote to Theo, when Gauguin asked for one of the sunflowers paintings, in January 1889: 'You know that Gauguin liked them extraordinarily. He said to me among other things – "That's ...the flower." You know that the peony is Jeannin's, the hollyhock belongs to Quost, but the sunflower is mine in a way' [573].

The *Portrait of Vincent van Gogh Painting Sunflowers* is carefully constructed to create an intimate image of the artist at work. Vincent remains oblivious of the viewer's scrutiny, so engrossed is he in his work. The viewpoint, from above and close up, brings the viewer right into the scene, but from the commanding position of an observer looking down at it. This is an unusual point of view: the typical nineteenth-century portrait of the Salon artist in the studio shows him or her posed in the surroundings of a successful and well-furnished studio. The Impressionists



11. Paul Gauguin, *The Grape Harvest, 'Misères humaines'*, 1888. Copenhagen, The Ordrupgaard Collection.

portrayed each other at work in a studio (for example, Auguste Renoir, *Bazille at Work*, 1867, Paris, Musée d'Orsay) or outdoors (Renoir, *Monet Painting in His Garden*, 1873, Hartford, Conn., Wadsworth Atheneum). Gauguin's portrayal places Van Gogh in this tradition, but interprets the activity with an altogether different psychological emphasis. Edgar Degas's portraiture (such as *Diego Martelli*, 1879, Edinburgh, National Gallery of Scotland) gave the precedent for the high viewpoint and the splayed composition. Gauguin carefully manipulated this format in order to make certain observations about Van Gogh's working habits and their limitations.

The composition is cropped so that all attention is focused on the act of painting. A spatial arena has been created around Vincent's hand by pushing all other elements to the edges of the composition. The artist gazes intently at the flowers through half-shut eyes,[21] as his taut arm and lightly flexed hand hold the brush to the canvas. This is a moment of stillness, not physical activity, as the painter ponders his next stroke. He seems to hesitate a moment between observing and recording the motif. Vincent van Gogh is closely bound up with his motif not only visually, through his gaze, but physically, in a more material sense. He shares the colours and shapes of the sunflowers, and sits very close to them as he paints. The flowers seem no further than arm's reach and his palette loaded with oil colours blends into the still life.[22] All the concentration and control of painting from the motif are visualised in the *Portrait of Vincent van Gogh Painting Sunflowers*, but with an added degree of intensity that suggests Van Gogh's commitment to this particular procedure in the face of Gauguin's insistence on working from memory.

The English term working 'from memory' reflects a variety of parallel terms employed by Gauguin and his colleagues. Its exact French equivalent, 'de mémoire', appears only once in Gauguin's correspondence, in the letters to Van Gogh in which Gauguin agreed to paint Bernard's portrait; otherwise, he used the more general terms 'travailler de tête', 'travailler d'imagination' or 'peinture de chic'. His use of these concepts in conversation in Arles is reflected in Van Gogh's letter.[23] Gauguin starts to employ the new terminology in his correspondence from the late summer and autumn of 1888; the terms reflect the theoretical discussion among Gauguin, Bernard, and Van Gogh. As the following quotations show, working from memory or 'the head' was closely related to the use of the imagination, and involved a process of abstraction based on the formal, expressive values of line and colour. 'Some advice: do not paint too much from nature. Art is an abstraction; extract it from nature, while dreaming in front of it, and think more of the creation that will be the result.'[24]

Working from memory seems to have been central to Bernard's procedures in 1888, and would have implied opposition to *plein-air* Impressionism. Modification and

questioning of strict *plein-air* practice had already preoccupied the Impressionists in the early 1880s; Gauguin was actively involved in this polemic, urging Camille Pissarro to work more in the studio.[25] But it was Georges Seurat's *Sunday Afternoon on the Island of the Grande Jatte*, 1885-86 (Chicago, The Art Institute of Chicago), exhibited in the Neo-Impressionist room at the last Impressionist group exhibition in 1886, which first presented a systematic challenge to plein-air practice and offered a paradigm of synthesis, abstraction and working from memory.[26] Seurat's example, read in the light of Symbolist opposition to shallow Realism, provoked the response of Cloisonism, developed by Louis Anquetin and Bernard in 1887-88.[27] It also stimulated the production of Gauguin's figure paintings of 1886-87, such as the *Four Breton Women*, 1886 (Munich, Neue Pinakothek, Bayerische Staatsgemälde-sammlung) and *Among the Mangoes at Martinique (fig. 10)*.

In practice, working from memory meant the use of drawings and studies; in effect, the approach suggests a return to aspects of tradition in the preparatory procedures used to develop a painting. Conceptually, working from memory emphasised memory and imagination in the creative process. Memory would act as a simplifying filter, allow-ing the artist to concentrate on the essentials in rendering the image. The goal was to arrive at a 'synthesis', and the result was often referred to as an 'abstraction'.[28] These may have been the central aesthetic issues discussed and argued in the winter of 1887-88 by Bernard, Gauguin and Van Gogh in Paris. The three-cornered discussion continued by letter once the artists had left for Brittany and Provence.

Gauguin had convinced Van Gogh to work from memory within a few weeks of his own arrival in Arles. 'I am going to set myself to work from memory often, and the canvases from memory are always less awkward, and have a more artistic look than studies from nature' [561]. Vincent van Gogh's statement clearly reflects Gauguin's arguments, and during their two months together in Arles he painted a significant number of 'abstractions', as he called paintings produced 'de tête'.

Vincent van Gogh had first been urged to paint from memory and to use his imagination to produce works of art by Émile Bernard. As early as 9 April, Van Gogh wrote to him, 'Sometimes I regret that I cannot make up my mind to work more at home and extempore. The imagination is certainly a faculty which we must develop, one which alone can lead us to the creation of a more exalting and consoling nature than the single brief glance at reality – which in our sight is ever changing, passing like a flash of lightning – can let us perceive' [B3]. Van Gogh clearly shared Bernard's goal of producing a consoling art based in reality, but not limited by the fleeting nature of perception. In the same letter, he argued that, while following a different creative method, he achieved a similarly simplified, expressive and non-illusionistic art as Bernard did working more conceptually. 'Working directly on the spot all the time, I try to grasp what is essential in the drawing – later I fill in the spaces which are bounded by contours – either expressed or not, but in any case felt – with tones which are also simplified.' This sounds very much like the synthetic drawing and dominant hue noted in Cloisonism by Dujardin.

Van Gogh normally refused to paint from memory, without the model. There is, however, one documented instance before Gauguin's arrival when he did. On 4 October, he wrote to Bernard that he had painted for him from memory a pimp and a prostitute making up after an argument, a scene that he had witnessed at the night cafe in Arles. 'I got busy painting it for you from memory on a little canvas. [...] I won't sign this study, for I never work from memory.' He concluded by noting that 'once again, I have painted a study for you which I should have preferred not to paint'. Vincent van Gogh underlined his strong feeling about not working without a model by telling Bernard that he had mercilessly destroyed two paint-ings, a Christ in Gethsemane and a Poet with Starry Sky, 'because the form had not been studied beforehand from the model [B19].

Bernard was in Pont-Aven with Gauguin at this time: Van Gogh had just received their self-portraits. Gauguin certainly read his letters addressed to Bernard, including the one cited above, with the conclusion 'I cannot work without a model'. This attitude must have presented an irresistible challenge which Gauguin took up once in Arles. It is clear from Van Gogh's letters that it was the successful completion of Gauguin's *The Grape Harvest, 'Misères humaines' (fig. 11)*, painted 'completely from memory', as much as any of his arguments, that convinced Van Gogh to try the method. As the weather became less hospitable to working out in the open, the two artists retreated indoors, painting 'from memory on bad days', as Van Gogh wrote to his brother in Paris, and producing 'peinture de chic' as Gauguin called it.[29]

Initially, Vincent was very enthusiastic about the new creative process. He watched Gauguin produce *Femme aux cochons: en pleine chaleur*, and himself painted two works from memory, *Woman Reading a Novel* and *Memory of the Garden at Etten*. 'Gauguin gives me the courage to imagine things,' he reported to Theo in mid-November, 'and certainly things from the imagination take on a more

mysterious character' [562]. By early December, Vincent seemed less enthusiastic about working from memory, and disappointed with at least some of the results. 'But I do not dislike trying to work from imagination. [...] Only I have spoiled that thing that I did of the garden in Nuenen, and I think that you also need practice for work from the imagination.' It was with evident joy and a sense of relief that Van Gogh started to paint a series of portraits of the Roulin family. 'But I have made portraits *of a whole family*. [...] You know how I feel about this, how I feel in my element' [560]. As he reports in the same letter, it was at this very moment, when Van Gogh had begun to abandon working from memory and turned back to painting from the motif, that Gauguin began the *Portrait of Vincent van Gogh Painting Sunflowers*.

Gauguin's conceptual approach is represented on the back wall in the oversize landscape painting; its simplified design contrasts with the packed foreground. No such landscape survives, although several paintings from Arles resemble it, and it seems quite likely that the image was invented by the artist for inclusion in the portrait. The broad, rhythmic bands of colour in the landscape introduce Gauguin's restful resolution to the creative process. Linking the artist's head with the painting on the easel without manual intervention, the bands almost seem to diagram the ideal projection of the mental image from the artist's imagination to the canvas surface in Gauguin's conceptual approach. The contrast with the intense and cluttered three-cornered relationship between artist, motif and painting-in-progress in the foreground is pointed. The sunflowers are lined up with the easel so that Van Gogh's brush hand appears literally to be painting them. The easel is seen in profile so that it barely registers, and the painting taking shape on he canvas is not visible. Working from the motif dominates Van Gogh's creative process entirely in Gauguin's portrayal.

In the *Portrait of Vincent van Gogh Painting Sunflowers*, Gauguin celebrated his colleague as the very type of the Impressionist painter working from his favourite motif of sunflowers. He recognised the special qualities of intensity and deliberation in Van Gogh's procedure of painting from life, but he also implied criticism of its limitations from the point of view of his own conceptual approach. The painting was clearly conceived in the context of the debates between Gauguin and Van Gogh about working from nature, about abstraction, and about the use of memory and imagination in the creation of a painting, as discussed above. It seems likely that the portrait was originally intended for Vincent, as a continuation of the portrait exchange begun in Pont-Aven. After the violent incident of mid-December, Gauguin may have decided against giving it to him because of its intensified presentation of his working from nature and the implied criticism that he was dominated by the motif. At that point, upon completion and as part of the process of reconciliation, it may have been redirected to Theo van Gogh, who was supporting Gauguin, as a gift and a token of continuing friendship with his brother Vincent. Ignoring its critical charge, Gauguin simply addressed the painting to him as an 'intimate' portrait of Vincent as the 'painter of sunflowers'. We do not know Theo's reaction to the Portrait of Vincent *van Gogh Painting Sunflowers*. Vincent van Gogh's comment in September 1889, that this was an image of him in the highly charged atmosphere of his sojourn with Gauguin in Arles, may have led Theo to see the image as a troubled and troublesome one.

NOTES

I wish to acknowledge the support of the Social Sciences and Humanities Research Council of Canada and Queen's University for research grants which enabled me to study the relevant paintings and documents in Europe. I would also like to thank my collaborators and co-authors, as well as Thea Jirat-Wasiutyński and Mark Antliff for general comments.

1. M. Roskill, *Van Gogh, Gauguin and the Impressionist Circle*, Greenwich (Conn.) 1970, p. 269, summarises the evidence for this date; see now V. Merlhès (ed.), *Correspondance de Paul Gauguin*, vol. 1, Paris 1984, no. 174 (fragments of a letter to Emile Schuffenecker, 25 October 1888). Gauguin left on 21 October and travelled by train directly from Pont-Aven to Arles, arriving in the early morning of 23 October, 'avec des changements de train à chaque instant', without passing through Paris, as stated in GAC 7, note 1.

2. The letter from Theo van Gogh offering to support Gauguin if he joined Vincent in Arles is lost, as is the artist's reply. Gauguin refers to the exchange of correspondence in a letter of early July (GAC 4). For further comment, see Roland Dorn's review of D. Cooper (ed.), *Paul Gauguin: 45 lettres à Vincent, Theo et Jo Van Gogh, Collection Rijksmuseum Vincent van Gogh, Amsterdam*, The Hague & Lausanne 1983, in *Oud Holland* 99 (1985), p. 325. The financial arrangement is discussed in letter 558.

3. Letters B7, B14, B15.

4. Letters 493, 500, 498, B7, B11. In letter 553a, Vincent van Gogh summarised his thinking about the support of artists. T. Kodera, 'Japan as Primitivistic Utopia: Van Gogh's Japonisme Portraits', *Simiolus* 14 (1984), pp. 201-03, discussed the artist's 'Gemeinschaftsideal'.

5. For the exchange see letter 535, GAC 32 and 33. Dorn, op. cit. (note 2), p. 325, for the date of the last letter. For a further discussion of the exchange see Jirat-Wasiutyński *et al.*, pp. 3-9.

6. GAC 12.

7. GAC 11, letter 565, GAC 12 and letter 564. The visit to the museum is discussed in V. Jirat-Wasiutyński, 'Vincent van Gogh's Magical Concept of Portraiture and Paul Gauguin's Bonjour

Monsieur Gauguin', RACAR: *Revue d'Art Canadienne/Canadian Art Review* 3 (1976), pp. 65-67.

8. J. van Gogh-Bonger, 'Memoir of Vincent van Gogh', in *The Complete Letters of Vincent van Gogh*, vol. 1, London 1958, pp. XLV-XLVI. There is no record of the family's reaction to the image. According to G. Wildenstein and R. Cogniat, *Paul Gauguin*, vol. 1, Paris 1964, no. 296, the painting was not exhibited until the 1905 Vincent van Gogh retrospective at the Stedelijk Museum, Amsterdam.

9. Paul Gauguin, *Avant et après*, Paris 1923, p. 20. For an earlier and probably more accurate account by Gauguin, see Émile Bernard's letter to Albert Aurier, Paris, 1 January 1889 (private collection), cited in part by J. Rewald, *Post-Impressionism: from Van Gogh to Gauguin*, New York 1962, pp. 267-68.

10. Roskill, op. cit. (note 1), p. 156, suggested the *Blue Trees* as closest in design.

11. Artist's manuals, such as P.L. Bouvier's *Manuel des jeunes artistes et amateurs en peinture*, Paris 1827 (English edition: *Handbook of Young Artists*, ed. and trans. by L. Osborn, New York 1845), pp. 124-25, warned the beginner that a minimum distance must be maintained between sitter and portraitist in order to avoid difficulties in the execution.

12. Roskill, op. cit. (note 1), p. 156, despite what Gauguin writes fifteen years later in *Avant et Après*, cit. (note 9), pp. 18-19!

13. In August 1887, Van Gogh painted F 375 and F 376; in August 1888, F 453, F 454, F 456 and F 459; in January 1889, F 455, F 457 and F 458. The latest scholarship on the sunflowers can be found in the auction catalogue *Van Gogh's Sunflowers*, London (Christie, Manson and Woods Ltd.), 20 March 1987, compiled with the assistance of R. Pickvance and R. Dorn, and in R. Dorn, *Décoration: Vincent van Goghs Werkreihe für das Gelbe Haus in Arles*, Hildesheim, Zürich & New York 1990, pp. 58-61, 73-80, 113-17. Gauguin recollected the decoration of sunflower paintings in 'Natures mortes', *Essais d'art libre*, January 1894, pp. 273-74.

14. F 410, F 592, F 593 and F 594.

15. W 602 and W 603. For a good colour reproduction of the version in Leningrad, see exhib. cat. *The Art of Paul Gauguin*, Washington (National Gallery of Art) 1988-89, no. 253. Richard Brettell is, however, wrong in stating that Gauguin first saw Van Gogh's sunflower paintings in Arles.

16. As Roskill, op. cit. (note 1), p. 156, points out.

17. The sketchbook, now in the Israel Museum, was published in facsimile by René Huyghe as *Carnet de Paul Gauguin*, 2 vols., Paris 1952. Roskill, op. cit. (note 1), p. 156, notes the studies. Z. Amishai-Maisels, 'A Gauguin Sketchbook: Arles and Brittany', *Israel Museum News* 10 (1975), pp. 71-72, discusses Gauguin's working method, but concludes that the compositional study was probably done after the painting to explain it to a colleague. It is our judgement that in its vigour the sketch resembles the notation of a first idea, as is the case in the sketch for the *Vision of the Sermon*, (Edinburgh, National Gallery of Scotland) found in the Album Walter (Paris, Louvre, Cabinet des Dessins), rather than a repeat notation such as one finds in the letters.

18. Gauguin refers to the exchange in GAC 24, which was written to Vincent, not Theo, in December 1887, not April/May 1889, as Dorn, op. cit. (note 2), p. 325, also points out. It is mentioned once again in letter 571.

19. Letters 526, 534, 558.

20. Letter 563. Roskill, op. cit. (note 1), p. 41, identified the Monet *Sunflowers* as the version from 1881 in the Metropolitan Museum of Art, New York.

21. This was the artist's established practice, according to Anton Kerssemakers in 1912; see letter 435c. Cited by A. Stiles Wylie, 'An Investigation of the Vocabulary of Line in Vincent van Gogh's Expression of Space', *Oud Holland* 4 (1970), p. 217, and by M.E. Tralbaut, *Vincent van Gogh*, Lausanne 1969, p. 318.

22. Roskill, op. cit. (note 1), p. 197, noted the intensity of this image of Van Gogh painting from the motif and the artist's identification with it in the colour scheme. Clearly, however, we disagree with his view that the artist 'bears down upon his subject across the full width of the canvas'. Nor is there any sign that Van Gogh is here 'still subject to this spell', that is, the spell 'of Gauguin's conception of the need to work from memory'. If there is any spell cast, it comes from the motif; yet, as pointed out in our text, the moment shown, namely the hand holding the brush, is one of deliberation.

23. In GAC 32, Gauguin referred to painting a portrait of Émile Bernard 'de mémoire' for Van Gogh. For 'peinture de chic', see GAC 8. Van Gogh's letters reflect the terms for painting 'de tête' or 'd'imagination' clearly – see letters 559, 561, 562, W9, 563, 560.

24. Merlhès, op. cit. (note 1), no. 159, to Emile Schuffenecker.

25. Ibid., nos. 17 and 23.

26. F. Fénéon, *Oeuvres plus que complètes*, ed. J.U. Halperni, Geneva & Paris 1970, pp. 73-74.

27. M. Stevens, 'Innovation and Consolidation in French Painting', in exhib. cat. *Post-Impressionism: Cross-Currents in European Painting*, London (Royal Academy of Arts) 1979-80, pp. 19-25. For the original critical statement, see E. Dujardin, 'Aux xx et aux Indépendants. Le Cloisonisme', *Revue Indépendante* 6, no. 17 (March 1888), pp. 487-92.

28. Merlhès, op. cit. (note 1), no. 159, refers to synthesis; abstraction and imagination are invoked there and in GAC 32 and 33, and in Merlhès, no. 168.

29. Letters 559, 561, and GAC 8.

Observations on Gauguin's Painting Techniques and Materials

H. Travers Newton

The *Portrait of Vincent van Gogh Painting Sunflowers* is painted on coarsely woven jute; the loose-weave structure is visible through the paint layer in places (*fig. 12*). The lean paint was applied sparingly over a thin lead-white ground. The unvarnished, matte paint surface shows little visible brushwork; a variety of subtle textures and some limited impasto characterise the surface. Large areas of solid colour dominate the image; the palette is comprised of reds, greens, blues and their 'muddy' combinations. The pale blue and yellow, however, are reflective of Van Gogh's palette. Pronounced contours and outlines in blue delimit the colour areas. Viewed as a part of Gauguin's development as an independent artist in late 1888, and in the context of his 'creative competition' with Van Gogh in Arles,[1] the painting, its technique and the effects it seeks to create, raise several issues – Gauguin's preference for thin as opposed to impasted paint; his creation of a matte, unvarnished finish; and his elaboration of subtly textured surfaces with the help of varied grounds and supports. For the artist, some of these techniques and materials implied a sense of primitivism.[2] Examination of documents written by Gauguin, Van Gogh, and other painters from Delacroix to Pissarro, as well as published nineteenth-century artists' manuals, underscore a major upheaval in the artist's approach to traditional methods and materials usage.[3] Since Gauguin and Vincent did not always follow rules prescribed by the artist's manuals, it would be foolhardy to state that we can document logical methodology in their work from the manuals. What we can discuss with reasonable clarity is which traditional practices they seemed to have respected, and which they did not. Vincent left a rich legacy of written documentation regarding his working methods in his letters; Gauguin left fewer indications, although there are some discussions of restoration and repair techniques.[4]

Vincent van Gogh painted with active, highly visible brushwork, occasionally leaving us glimpses of his underdrawing, and a large corpus of his field sketches and working drawings has fortunately survived. Gauguin, on the other hand, worked in a more meticulous, almost secretive manner, rarely showing us a brushstroke or underdrawing, and rarely writing about his technique. He was not a prolific draughtsman, and there are few extant drawings, although many may have been destroyed after his death.[5]

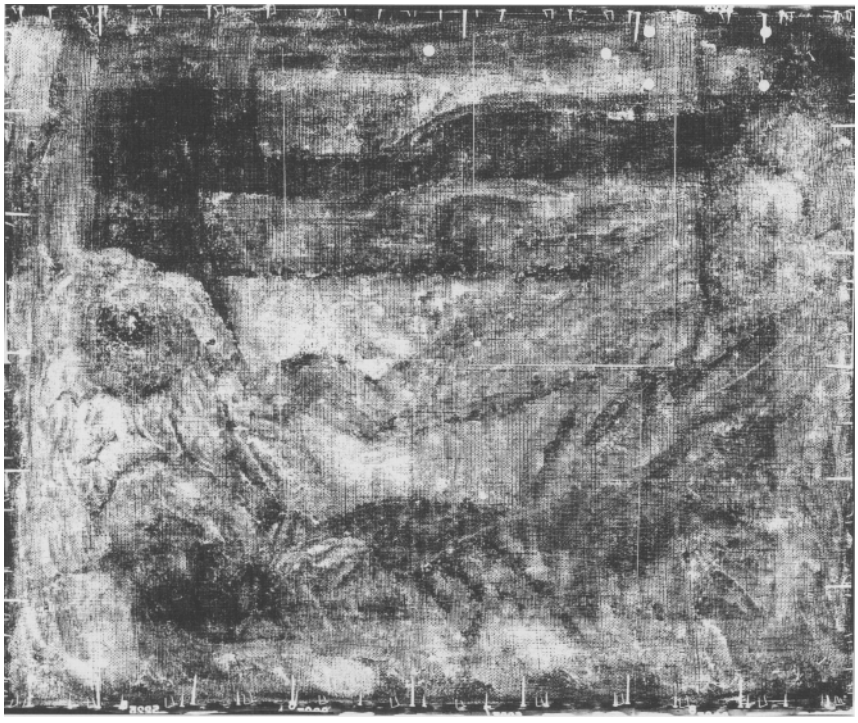
Much of the technical information that Gauguin and Vincent absorbed was empirical and passed on by word of mouth among artist friends such as Paul Signac, Emile Schuffenecker, Bernard, Pissarro, Toulouse-Lautrec, Degas and Mauve; by teachers such as Cormon; while artists' colourmen like Tanguy and Latouche probably had an influence as well. The point is that Gauguin and Vincent represent the first wave of non-academically trained artists, so that it is often difficult to separate invention from emulation.

Vincent van Gogh's library survives in large part, along with his brother's, at the Rijksmuseum Vincent van Gogh. Little is known about Gauguin's library, but as he was a knowledgeable collector, amateur artist and man of means in the 1870s, we feel it safe to assume that he was familiar with some of the artist's manuals of the time.[6]

A reading of these manuals indicates that Gauguin may have followed certain techniques prescribed for practical as well as aesthetic reasons, such as the use of a rough weave fabric combined with a thin priming to avoid problems of flaking paint that both artists encountered in Arles.[7] By nature the manuals tended to document traditional and often academy-associated practices: none appear to have advised leaving the paint surface unvarnished, for example, even though concerns about yellowing and darkening varnish were widespread.[8] Clearly, Gauguin turned to the manuals selectively.

His portrait of Vincent is based on at least two quickly drawn sketchbook page notations.[9] In the drawing on page 41 of the Arles sketchbook (*fig. 8*), Gauguin refines Vincent's facial features, giving him a pronounced nose,

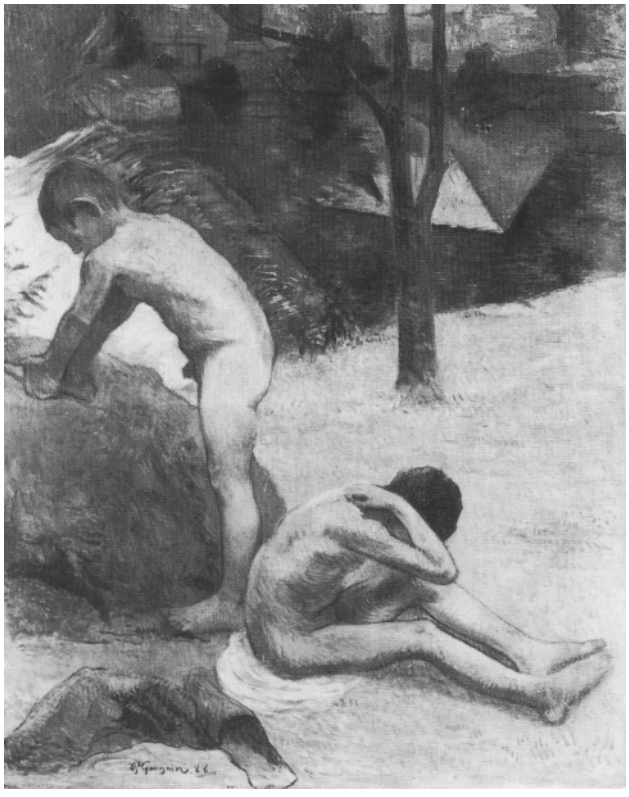
12. Portrait of Vincent van Gogh Painting Sunflowers, detail upper right corner.



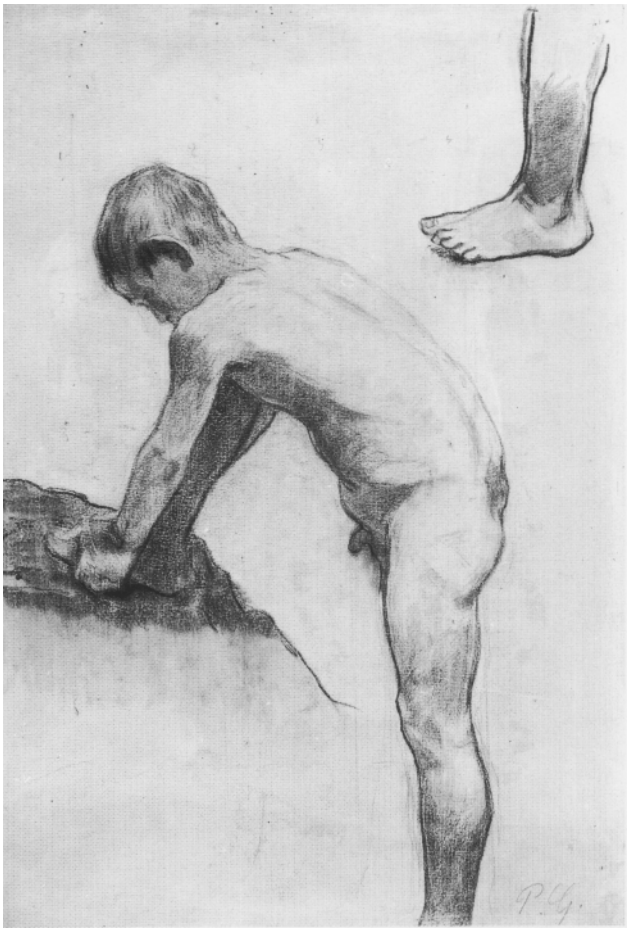
13. Portrait of Vincent van Gogh Painting Sunflowers, x-ray photograph.

chin and moustache, somewhat reminiscent of his own features in the self-portrait that he painted for Vincent. There are three sunflowers drawn in a vase, although more were added in the painting. Sketchbook page 70 (*fig. 9*) renders the overall composition with emphases on Vincent's right arm locked into a horizontal position and the left shoulder hunched, conveying an ambiguous sense that the artist was either working in a cramped space or that Vincent's movements were awkward. It is possible that Gauguin had some problems delineating the perspective. The drawing suggests that he also encountered some difficulty in rendering Vincent's features, particularly the shape of the nose and the outline of the jaw and chin, which were redrawn several times in the sketch.

Although the painting differs from the two sketches in several respects, examination of the picture in transmitted light (fig. II, p. 92), and in ultraviolet fluorescence (fig. III, p. 92), indicates that there may be only slight compositional alterations in the painting itself (such as in the peak of Vincent's hair and in the upper outline of his outstretched arm). Gauguin made several compositional changes between the sketchbook pages and the painting, for example by lowering Vincent's right arm considerably in the painting, by tilting his body more fully towards the viewer, strengthening the sense of three-quarters profile from a lost profile, and adding a fourth (and possibly a fifth) sunflower with elegant, drooping leaves.



14. Paul Gauguin, Young Bretons Bathing, 1888. Hamburg, Hamburger Kunsthalle.



15. Paul Gauguin, *Young Breton Bathing*, 1888. Paris, Musée du Louvre, Département des Arts Graphiques.

The x-ray is so thin that it is almost unreadable, but suggests that one should not rule out other adjustments (*fig. 13*). There may have been changes in the position of Vincent's proper right arm, the central portion of the background image, and the easel. Areas of less density or negative space in the lead-white ground, for example the outline of Vincent's head, indicate that Gauguin either primed the canvas selectively, as if he had drawn in the composition on the bare canvas before priming and then selectively applied the lead-white ground, or that he began working on the picture before the ground had a chance to

dry and somehow deliberately eroded it in the areas of outline.

These minor changes and the careful control of the painting design suggest that Gauguin may have prepared the figure and composition of the *Portrait of Vincent van Gogh Painting Sunflowers* in a larger, more finished drawing (now lost) than the sketches discussed above, although it is also conceivable that he felt confident enough to work freely from the small studies. However, this was not his practice after 1886 for important figure paintings. In that year, he prepared the *Four Breton Women* (Munich, Neue Pinakothek, Bayerische Staatsgemäldesammlung) in full-scale chalk drawings of the Bretonnes. The precise method that he used to transfer the drawings is not clear; in subsequent paintings, such as *Among the Mangoes at Martinique* (*fig. 10*), and the *Young Bretons Bathing* (*fig. 14*), he carefully squared the drawings up for transfer (*fig. 15*). On the other hand, no large preparatory drawings survive for the *Vision of the Sermon* (Edinburgh, National Gallery of Scotland) or for the *Self-Portrait with Portrait of Bernard, 'Les Misérables'* (*fig. 2*), although the forceful, carefully controlled figure drawing in both suggests that there may once have been full-scale studio drawings.[10]

As was the case in his *Self-Portrait* (*fig. 2*), no traces of underdrawing have been detected by infrared or X-ray in Gauguin's *Portrait of Vincent van Gogh Painting Sunflowers* apart from the outlines visible on the surface of the painting.[11] He may have underdrawn the image in material that we cannot detect, as he did in other pictures, such as the *Four Breton Women*.[12] The fact remains that we do not know how Gauguin began the portrait.[13]

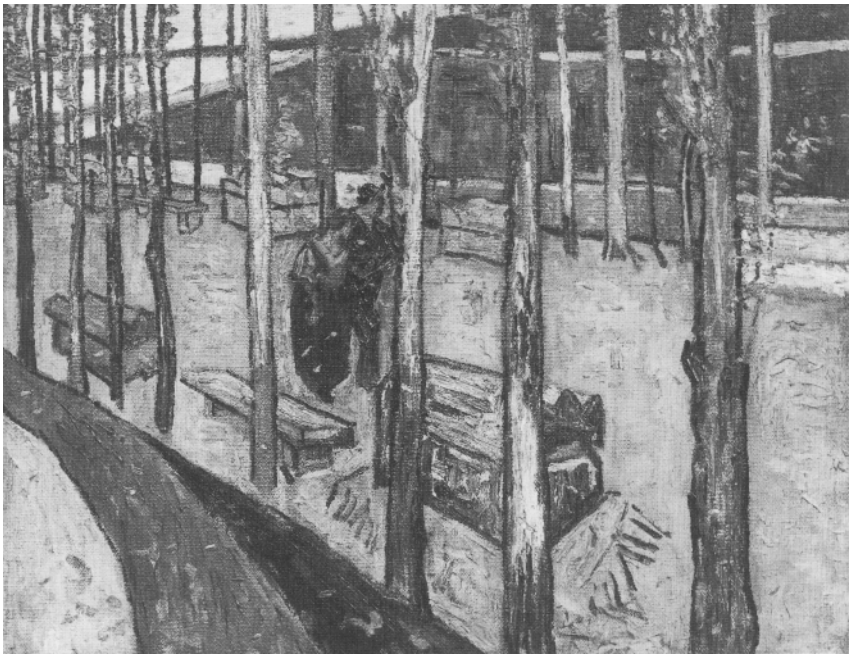
It is painted on a coarse jute fabric which Gauguin prepared, after stretching the fabric on a simple mortise five-member stretcher, with a thin ground of lead white. This may be the 'very strong canvas',[14] of which Gauguin purchased 20 metres in November, according to Vincent. Such a coarse weave canvas was also used by Vincent van Gogh, and it forms the support in many paintings from Arles by the two artists.[15]

It is a plain weave fabric of about seven or eight threads per square centimetre.[16] Its coarse weave produces a characteristic textured surface that is visible through the thin ground and paint layer that Gauguin applied. It contrasts with the fine surfaces visible in his previous paintings. The self-portrait inscribed *'les misérables'* (*fig. 2*), for instance, is painted on a fine cotton fabric; even here, Gauguin responded to the texture by using it unprimed and roughing up the fibres in places.[17] Thanks to the influence of Pissarro and Degas, Gauguin had been interested in the effects of matte surfaces and the subtle textures of thin paint on varied canvas weave throughout the 1880s.[18]

Gauguin may well have bought the 'coarse sacking' in early November and initiated its use in Arles as part of his campaign to rationalise Van Gogh's household and studio operations, and so reduce expenses.[19] He used it, perhaps for the first time,[20] in early November for the *Allée des Alyscamps* (W 306, private collection). Van Gogh's earliest use probably occurred at the same time, in *Les Alyscamps, Autumn* (Otterlo, Rijksmuseum Kröller-Müller, F 486), and in its counterpart in a private collection (*fig. 16*). The matte paint, applied sparingly over a thin ground, allows the texture of the coarse weave fabric to show in both paintings, as it does in the Gauguin. Brushwork plays no significant role in these paintings as it had in earlier impasted works by Van Gogh. This, coupled with a strongly 'Cloisonist' style, certainly suggests the influence of Gauguin in technique and style, soon after his arrival in Arles. His opposition to Van Gogh's 'accidents of impasto' and 'messing with brushwork' is well known.[21]

The immediate motivation for Gauguin's purchase of the coarse jute fabric was, nevertheless, probably monetary; it cost only 50 centimes per metre as opposed to 2 or 2.50 francs for the colourmen's canvas.[22] Other practical considerations may have affected Gauguin's choice of the 'coarse sacking', as he called it. There is no indication that he knew that it was jute, but he noted that it was durable.[23] He was probably thinking of it as analogous to hemp, which was known for its tensile strength in painter's manuals. Bouvier, for instance, recommended that a coarser fabric support be chosen for its 'tooth', an advantage in holding paint, and recommended the use of a thin ground for this reason.[24] Gauguin certainly used a thin ground (see the X-ray) and the adhesion between paint and ground layers and the support has remained excellent in the *Portrait of Vincent van Gogh Painting Sunflowers*, save where the jute support has sheared.[25]

Gauguin may also have been attracted by the primitivism of the rough look and feel of the sacking, which was used in dialogue with his subtle paint handling. He ignored the traditional advice of the manuals 'that the cloth be as free as possible from knots [... and that] these be covered' and that 'the fineness of the cloth should be proportional to the size and subject of the picture'.[26] He painted his easel-size paintings on coarse jute, leaving the weave and knots visible. In a letter to Theo van Gogh, Gauguin implied a parallel between the coarseness and virility of the subjects of *The Wine Harvest, 'Misères humaines'* (*fig. 11*), and *Woman in the Hay with Pigs* (private collection) and the coarse materials



16. Vincent van Gogh, *Les Alyscamps, Autumn*, 1888. Private collection.

and bold painting procedures that he had used.[27] In another letter of about the same time to Bernard, already quoted, he pointed out that Vincent van Gogh 'is romantic and I more inclined toward a primitive state. In terms of colour, he favours the accidents of impasto as in Monticelli and I detest messing with brushwork'.[28] Gauguin's use of coarse sacking was probably meant as a response to Van Gogh's painterly impasto and as a deliberate primitivism:[29] its physical and visual presence in the *Portrait of Vincent van Gogh Painting Sunflowers* reinforces the imagery of the painting.[30]

The portrait has never been varnished, and retains its original chalky and matte surface. Gauguin may have enhanced these effects by leaching out the oil in his paints before application, as the Impressionists were reported to have done.[31] Painters such as Monet, Renoir, Pissarro and Degas adopted unvarnished, lean paint surfaces in opposition to the notion of academic finish.[32] The thin ground also contributed to the dry look of the paint surface: although it consists of lead white, its thinness means that it has acted like a semi-absorbent ground, allowing the oil from the paint layer to penetrate into the porous support. Fortunately, the tacking margins of Gauguin's painting are still preserved, and one can see that the lead-white ground was applied to the jute after it was mounted on a stretcher, possibly with a flat instrument such as a palette knife, judging by the scraped tool marks in the ground which are visible in the x-ray (*fig. 13*).

A thin layer of the lead-white ground, suspended in a medium of walnut oil with a small percentage of castor oil that was either leached from the paint film or was a component of the ground, was spread upon the jute.[33] Gauguin may have further diluted the lead white in oil or solvent, since it was applied quite thinly, probably only in one application, leaving many of the elevated canvas nubs almost bare. The jute fibres have absorbed a considerable amount of oil from the ground and paint layers, and fibre samples removed exhibit a brownish colour which is due to oxidation of the jute (rich lignin content), a thick layer of protein glue (probably animal glue) that was first applied to the jute after stretching, and oil from the paint and ground layers.

We have seen that Vincent van Gogh shared aspects of Gauguin's style and technique, including a matte paint surface, in a number of paintings from the autumn of 1888. It seems likely that he had accepted the logic of Impressionist and Neo-Impressionist techniques in at least some cases, and did not varnish a number of his post-Parisian paintings (from 1886 on). There is evidence in his letters to Theo that he was using absorbent grounds and seeking matte effects in the spring of 1888.[34] We know that Gauguin persuaded Van Gogh to wash his paintings to get rid of the grease in the impasto; the colours would thus retain their brilliance.[35]

Certain observations can be made about the types of pig-

17. Paul Gauguin, *Portrait of Vincent van Gogh Painting Sunflowers*, showing the points at which the paint samples in fig. IV, p. 93, were taken.

ment that Gauguin used in his portrait of Vincent as a result of microscopic analyses of a limited number of paint samples (*figs. 17*, IVa–f, p. 93). These were removed during the recent restoration to determine the nature of the various surface coatings, the nature of the ground and its possible reaction to moisture, and other factors relating to the conservation of the picture. The analyses yielded information regarding paint application and mixing. For example, Vincent's hair has a dull reddish-orange cast with brownish shadows; a paint sample (fig. IVa) from the hair shadow suggests that Gauguin underpainted the hair in a fairly thick layer of bright vermilion, possibly hand-ground judging by the large particle size,[36] and then toned it down with a thin layer of a mixture of chrome yellow, synthetic ultramarine blue and vermilion, yielding a greenish-brown hue. In sample B (fig. IVb) from the light blue background wall at upper left, Gauguin covered the white ground with a mixture of lead white and finely ground synthetic ultramarine. (Traces of vermilion particles suggest that he did not completely wash out his brush.) In sample C (fig. IVc), the yellow paint from Vincent's palette, Gauguin applied a layer of pure chrome yellow over the ground; a very thin transparent brown layer on the surface of the sample suggests a possible chemical alteration of the chrome yellow. Sample D (fig. IVd), of light blue and yellow paint from the outlines of one of the sunflowers, shows that Gauguin applied a thick layer of pure chrome yellow over a thin layer of lead white mixed with synthetic ultramarine. This sample also has a thin transparent brown layer on top. Gauguin probably corrected the blue outlines of the sunflower with the yellow overpaint.[37] Analysis of the horizontal green stripe in the background (fig. IVe) shows it to be a layer of three pigments mixed together: copper green (copper acetoarsenite, known as emerald green) with chrome yellow and a small amount of synthetic ultramarine blue (fig. IVf). The blue particles are found on the bottom of the sample and may reflect a type of underpainting.[38]

There is evidence that Gauguin may have underpainted certain passages in bolder colours with the intention of toning down those areas with later colour mixtures. For instance, Vincent's hair is underpainted in vermilion, but was toned down with green and brown.[39] In other areas he may have keyed-up the base tone. In the green in the background painting Gauguin may have keyed-up the green, starting with a mixture of chrome yellow and ultramarine blue and ending with a uniform top layer of a more garish emerald green. The yellow layer over the blue outline of the sunflower also suggests some slight alterations and gives a hint of Gauguin's careful working pace. In Vincent's red hair, he created shadows not by glazing, in which a transparent layer of colour such as Van Dyke brown would be superimposed on the base layer, but by using a muddy hue comprised of ultramarine blue, synthetic chrome yellow, and vermilion. The theoreticians of colour would have

shuddered at this muddy mixture; but it foreshadows Gauguin's penchant for the turbid combinations of pigments that would evolve in his Tahitian pictures.[40]

The pigments found here are, nevertheless, close to those used by his teacher Camille Pissarro for the compo-sition of his palette dating from the 1870s: lead white, vermilion, emerald green, chrome yellow. Pissarro also included a transparent dark red (possibly alizarin crimson); and instead of synthetic ultramarine, he used the much more costly natural ultramarine, lapis lazuli.[41]

The inclusion of a green in both Gauguin's and Pissarro's palette is a slight deviation from the rule of using only the three primaries. Cézanne quoted Pissarro in 1865 as saying that one should eliminate the earth colours and paint 'avec les trois couleurs primaires et leurs dérivés immédiats'.[42] Essentially this was the traditional claim by then, as we find it in Regnier's book, *De la lumière et de la couleur chez les grands maîtres anciens* of 1865: that all the colours of nature can be reproduced with Naples yellow, madder lake and ultramarine blue.[43] We can say that Gauguin's selection of hues for his portrait of Vincent (the three primaries plus green) was traditional, and comprised of pigments used by Vincent in his Arles period.[44] Generally speaking the samples indicate a relatively direct system of paint application, with no significant glazing between layers. Like many Impressionists, Gauguin appears to have selected opaque over transparent pigments; or he would mix white with semi-transparent pigments (for instance, he mixed synthetic ultramarine with lead white).

These samples show that Gauguin, like the Impressionists, and like Van Gogh after 1886, also embraced the new colour values, particularly the use of highly keyed emerald green and chrome yellow. His use of bright colour began in 1879 with his exposure to Impressionism and the teaching of Camille Pissarro (see the *Market Gardens at Vaugirard*, 1879, Northampton, Mass., Smith College Museum of Art; and the *Breton Shepherdess*, 1886, Newcastle, Laing Gallery of Art). By the summer of 1888 he was painting in larger areas of solid colour rather than using the broken brushwork of the Impressionists. This was the result of renewed contact with Émile Bernard and the influence of Japanese prints in the winter of 1887-88; Vincent van Gogh provided the impetus for both.[45]

It is the use of solid blocks of colour masses, the structure of which is already apparent in the geometric application of the white ground, which sets Gauguin's technique apart from Van Gogh's. The marked, but subtly varied use of outline in the *Portrait of Vincent van Gogh Painting Sunflowers* and contemporary paintings derives ultimately from the practice of Camille Pissarro, as well as from the later influence of Cézanne and Bernard. The emphasis on outline and large areas of colour can be compared with Bernard's 'Cloisonism';[46] such a simplified painting style has a well-established history and place in decoration. Chevreul called it 'flat painting' and discussed it briefly as an alternative to relief or 'chiaroscuro painting' in his treatise of 1839, *De la loi du contraste simultané des couleurs*.[47] Bernard and Gauguin associated this technique with 'synthesis' and the use of memory and imagination in the production of a painting; Van Gogh called such works 'abstractions' and adopted a similarly 'flat' technique, as in his *Memory of the Garden at Etten*, 1888 (Moscow, Pushkin Museum). But it was Gauguin who developed 'flat painting' into the style of the Pont-Aven group and assured its prominence among the Parisian avant-garde (the Nabis, for example) in the 1890s, and the fashion for unvarnished paint surfaces had been set for the twentieth century.[48]

NOTES

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1. As discussed by E. van Uitert, *Vincent van Gogh in Creative Competition: Four Essays from Simiolus*, Zutphen 1983.

2. GAC 9.

3. See A. Callen, *Techniques of the Impressionists*, London 1988.

4. See Jirat-Wasiutyński *et al.*, pp. 17-20. Regarding Van Gogh's library, see F. Pabst and E. van Uitert, 'A Literary Life, with a List of Books and Periodicals Read by Vincent van Gogh', in E. van Uitert and M. Hoyle (eds.), *The Rijksmuseum Vincent van Gogh*, Amsterdam 1987, pp. 68-84.

5. Gauguin's secretive attitude emerges in this late polemical statement: 'A critic at my house sees some paintings. Greatly perturbed, he asks for my drawings. My drawings? Never! They are my letters, my secrets. The public man, the private man.' Paul Gauguin, *Avant et après*, Paris 1923.

6. Manuals such as P.L. Bouvier, *Manuel des jeunes artistes et amateurs en peinture*, Paris 1827 (English edition: *Handbook of Young Artists*, ed. and trans. by L. Osborn, New York 1845); C. Blanc, *Grammaire des arts du dessin, architecture, sculpture, peinture*, Paris 1867 (see also the English edition, *The Grammar of Painting and*

Engraving, trans. K. Doggett, New York & Cambridge (Mass.) 1874); M.E. Chevreul, *De la loi du contraste simultané des couleurs*, Paris 1839 (see also the English edition, The Principles of Harmony and Contrast of Colors and Their Applications to the Arts, intr. F. Birren, New York 1981); F.A.A. Goupil-Fesquet, *Manuel complet et simplifié de la peinture à l'huile*, Paris 1877; J.N. Paillot de Montabert, *Traité complète de la peinture*, 9 vols., Paris 1829-51.

7. GAC 34: 'The whole *Vintage at Arles* has flaked because of the white, which has separated', Gauguin to Vincent, ca. 9-17 January 1889. See Bouvier, op. cit. (note 6), p. 116, for his reference to coarser canvas holding the paint better. Gauguin's restoration of the *Vintage* is discussed in Jirat-Wasiutyński *et al.*, p. 17.

8. Blanc, *Grammar*, cit. (note 6), p. 183, pointed out that unvarnished distemper paintings are 'less liable to grow brown than oil painting,' and that 'tempera has almost as much consistency with less heaviness'.

9. The Arles/Brittany sketchbook of 1888-90, now in the Israel Museum, was published in facsimile in R. Huyghe, *Carnet de Paul Gauguin*, 2 vols., Paris 1952. A systematic study will be found in Z. Amishai-Maisels, 'A Gauguin Sketchbook: Arles and Brittany', *Israel Museum News* 10 (1975), pp. 68-87. On pp. 71-72 she discusses Gauguin's production and use of the drawings in relation to paintings such as the *Portrait of Vincent van Gogh Painting Sunflowers*.

10. Gauguin's preparatory procedures, including the use of drawings for the above mentioned paintings, are discussed in V. Jirat-Wasiutyński and T. Newton, 'Tradition and Innovation in the Painting Technique of Paul Gauguin', *Colloque Gauguin*, Musée d'Orsay, Paris, January 1989 (in press).

11. There has been no examination in infrared refectography.

12. See exhib. cat. *Impressionist and Post-Impressionist Masterpieces from the Courtauld Collection*, New Haven & London 1987, p. 32 (in reference to *Haymaking*): 'Gauguin used the pigment Prussian blue both to sketch in the composition and to give final definition to the forms once painted. As Prussian blue appears dark in infra-red, it is possible to see the degree of reworking that exists and the difficulty that Gauguin had with the composition.'

13. Bouvier, op. cit. (note 6), p. 170, describes several transfer processes or 'chalking': 'The back of the design is smeared over uniformly with white or red chalk, or even charcoal, and the paper being fastened to the canvas by a couple of wafers at the two top corners, the caulked side next the cloth, the artist goes diligently over all the lines of his design, with any instrument that may trace them neatly without cutting through the paper.'

14. Letter 559. Gauguin mentions its use by Van Gogh in V. Merlhès (ed)., *Correspondance de Paul Gauguin*, vol. 1, Paris 1984, no. 177.

15. Ten or fifteen paintings by Gauguin are probably on this coarse fabric: W 304, W 305, W 302, W 303, W 309, W 297, W 296, W 306, W 311, W 301. Vincent van Gogh used it for at least six works: F 450, F 486, F 487, F 489, F 498 and F 499.

16. See the contribution by Cornelia Peres, 'Condition and Conservation Report'.

17. See Jirat-Wasiutyński *et al.*

18. See Jirat-Wasiutyński and Newton, op. cit. (note 10).

19. Letters 557, 558, concerning cheaper, hand-ground paint and the preparation of canvas by the artists themselves. Gauguin had acquired his knowledge of canvas varieties from his work in 1884-85 for Dillies and Co.

20. See auction catalogue, *Impressionist and Modern Paintings and Sculptures*, C. Godfrey and R. Pickvance (eds.), London (Christie's), November 1988, pt. 1, lot 16.

21. Merlhès, op. cit. (note 14), no. 182, to Bernard. The *Portrait of Vincent van Gogh* was painted at about the time of this letter: in it Gauguin shows Van Gogh working with an 'oblong-square' palette, which Bouvier, op. cit. (note 6), p. 102, suggested was not suitable for close work, but rather for projects where a large quantity of paint is used.

22. GAC 9, Gauguin to Theo van Gogh.

23. Ibid., and Merlhès, op. cit. (note 14), no. 177, to Bernard.

24. Bouvier, op. cit. (note 6), p. 116. Adhesion did, however become a problem in the *Vintage at Arles*, for which see Jirat-Wasiutyński *et al.*, p. 17. In GAC 33, Gauguin mentions that he used lead white ('céruse') instead of 'blanc d'argent': 'N'ayant pas de blanc d'argent j'ai employé de la céruse et il pourrait bien se faire que la couleur descende et s'alourdisse'. See R. Mayer, *The Artist's Handbook of Materials and Techniques*, New York 1981, p. 49, where French white is defined as silver white, and p. 63: 'silver white is a nonstandard term that has been used for both flake and zinc whites'.

25. See the contributions by Vojtěch Jirat-Wasiutyński, and Cornelia Peres, 'Condition and Conservation Report'.

26. Bouvier, op. cit. (note 6), p. 116

27. GAC 9.

28. Merlhès, op. cit. (note 14), no. 182.

29. Primitivism was an important aspect of Gauguin's painting in the summer of 1888, and also in his debates and experiments with Émile Bernard between August and October 1888. See Merlhès, op. cit. (note 14), nos. 156, 158, 159, 165; letter B14; GAC 6, 7, 30, 32, 30.

30. See above, Section 1, and note 19 above.

31. Callen, op cit. (note 3), p. 24

32. C. Rosen and H. Zerner, *Romanticism and Realism*, New York 1984, p. 223, in a discussion of 'The Ideology of the Licked Surface'.

33. Bouvier, op. cit. (note 6), p. 70, says that poppy, linseed and nut (walnut) oils are the three oils proper for painting. Further research is needed to determine whether the walnut and castor oil mixture was commercial, or one that Gauguin prepared himself.

34. Letter 475, but note that this only refers to absorbent ground. Paintings such as the *Farmhouse in the Wheatfield* (Amsterdam, Rijksmuseum Vincent van Gogh, F 408) of May 1888 and the *Gypsy Encampment* of August 1888 (Paris, Musée d'Orsay, F 445) may relate to these experiments. See letters B6 and 487, for the former, and 522 for the latter. Both are painted on unprimed canvas.

35. Letter 563. Compare G.F. Watts's process of 'oiling out', discussed by C. Willoughby, 'Search for Permanence: Materials and Methods of G.F. Watts (1817-1904)', in H. Althöfer (ed.), *Das 19. Jahrhundert und die Restaurierung*, Munich 1987, p. 212. Much more research is needed to determine Vincent van Gogh's attitude towards these technical issues and their aesthetic context before a full account can be given of his artistic dialogue with Paul Gauguin in Arles.

36. Vincent van Gogh wrote to Theo that he and Gauguin

would save money by preparing their own canvas and colours. See letters 557, 558.

37. Vincent mentions Gauguin in reference to the retouching or reworking of paintings in letter 563.

38. See the discussion above, pp. 107-108.

39. In this respect, it is interesting to compare the bright red hair of *Christ in Gauguin's Christ in the Garden of Olives* of 1889 (West Palm Beach, Florida, Norton Gallery).

40. O. Rood, *Modern Chromatics*, London 1879 (facsimile ed. by F. Birren, New York 1973), p. 180, wrote: 'Mixtures of red and green light produce yellow light of so inferior a character.'

41. Based on an unpublished analysis of Pissarro's *Palette with Peasants Harvesting Hay*, 1870s (Williamstown, Mass., Clark Art Institute).

42. Cézanne quoted in R. Shiff, *Impressionist Criticism, Impressionist Color, and Cézanne*, Ph.D. thesis, Yale University 1973, University Microfilms, Ann Arbor, Michigan, p. 130.

43. See Shiff, op. cit. (note 42), p. 125.

44. See the discussion in Shiff, op. cit. (note 42), pp. 199, 206-07. See also the pigment analyses in Jirat-Wasiutyński *et al.*

45. B. Welsh-Ovcharov, exhib. cat. *Vincent van Gogh and the Birth of Cloisonism*, Toronto (Art Gallery of Ontario) 1981, pp. 28-29

46. See, for example, V. Jirat-Wasiutyński, 'Cloisonism, Symbolism, Synthesism', RACAR: *Revue d'Art Canadienne/Canadian Art Review* 9, nos. 1-2 (1982), pp. 35-46.

47. Chevreul, op. cit. (note 6), pp. 124-25.

48. Further research is needed to clarify the role of artists such as Pissarro, Cézanne, Degas and Monet in experimenting with unvarnished surfaces, probably starting in the 1870s.

Condition and Conservation Report

Cornelia Peres

There were two goals in treating Gauguin's *Portrait of Vincent van Gogh Painting Sunflowers*: to return the picture to public view, and to retard further deterioration of the jute support. Any treatment would have to respect the visual authenticity of the original materials and their distinctive handling. The aesthetic effects that Gauguin achieved in the portrait are inseparable from the subject and its interpretation, and are as important. Historical records make it quite clear that Gauguin, like Monet, Pissarro and Degas, was very concerned with the technique and presentation of his works, for both aesthetic and prac-tical reasons.[1]

Gauguin set out to create a specific aesthetic effect with the matte, unvarnished and variously textured surfaces of the painting. These range from smooth, semi-transparent, wash-like areas to roughed-up textures and limited impasto. This painting surface is extremely sensitive, and any intervention, whether accidental or in connection with a conservation treatment, is almost certain to produce a lasting change. The textured and matte surface effects of the painting are equally dependent on the coarse-weave jute support and the thin lead-white ground.

Preserving the physical and visual properties of the image would seem to rule out any thorough impregnation of the support, which might penetrate the ground layers and show on the face. The microstructure of the painting is so open and the jute so absorbent that it would soak up any fluid to an irreversible degree.[2] Moreover, any treatment would not only have to avoid changing the refraction index of the paint layer, but would also have to maintain the integrity of the whole complex of support, ground and paint layer in order to preserve the aesthetic effects envis-aged by Gauguin. Since the *Portrait of Vincent van Gogh Painting Sunflowers* is one of the very few works painted on jute which has not been lined and restored, it seemed extremely important to preserve it with the minimum of intervention.

The task was to find a reversible method to support the jute. The dilemma was that neither the methods of lining and consolidation presently practised, nor the materials used were fully compatible with the materials and structure of Gauguin's painting.[3] In order to guarantee reversibility, the adhesive and supporting material would have to be no stronger than the extremely fragile jute support. Clearly, an upright hanging position for the painting could only be envisaged if it entailed no risk to the painting. It became apparent that alternative supporting systems for the portrait would also have to be investigated. Rather than risk compromising the painting itself, a compromise might have to be made as regards the method of display. On the other hand, any presentation of the picture would have to ensure that it retained its visual integrity and looked like a conventional, stretched and framed canvas.[4]

ANALYSIS OF THE SUPPORT

Analysis of sample fibres from the support showed it to be jute (fig. v, p. 96), a fibrous material which, textile conservators generally agree, is 'neither strong nor particularly stable, [which] degrades quite rapidly, and is good quality for this genus'.[5]

The cells are fairly regular and fine and the cell ends taper gradually. There are some pieces of epidermis mixed with the fibres which do not show any marked characteristics (*fig. 18-19*). Jute has some cluster crystals which are either isolated or mixed with rhombic crystals in chains. It is made of the bark of the jute plant. Its 'reprise' (i.e. the amount of humidity which a dry fibre can absorb in normal air of 65% RH) is 13.5%, and it can absorb 25% water by weight without feeling damp. By comparison, the reprise of linen is 12% and its water absorption 20%.

The canvas has a simple weave pattern with quite a coarse structure. Density: 7 to 8 threads per square centimetre (the same amount on the warp and the weft), weight: 290 g/m^2.

The jute plant grows in tropical and subtropical zones. It has been known in Europe since the end of the eighteenth century, where it has been produced since the mid-nineteenth century, mainly in England, principally for use as a cheap textile packing material. At the end of the nineteenth century it was also used for paintings, and even became available as an industrial, preprimed canvas.[6]

Jute fibres are hygroscopic and very rich in lignin, which may account for the poor qualities of woven jute fabric.[7] Jute has poor resistance against protracted humidity, and will rot under the action of bacteria. Under the influence of air (oxidation) and light (photodegradation), it disintegrates quite rapidly, becoming brittle and weak.

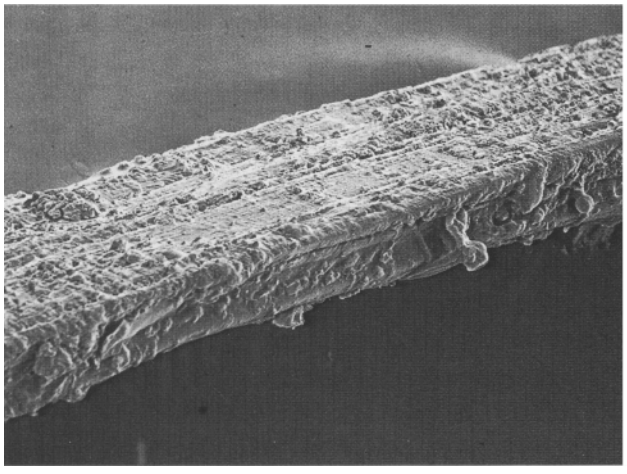
The basic jute support of the *Portrait of Vincent van Gogh Painting Sunflowers* is indeed weak, and there is evidence that it has deteriorated under the influence of air and light, a process which is still continuing. The fabric is made of coarse threads; the long fibre bundles (characteristically 1 to 3 metres in length) have been split by deterioration into their elementary fibres (1 to 5 mm. in length). These are still bound into the weave structure, but only very loosely, which gives the reverse of the canvas a rather hairy look.

The stress of vertical display has also damaged the fibres. Closer examination under the microscope, documented in the colour slides, shows that they have split, broken, and are partially unravelled. It also reveals that the upper fibres have separated from the threads at various points. The main stress on the fibres of the vertical threads along the upper edge has, however, been caused by the weight of the canvas itself (fig. VI, p. 96). Additional tearing tensions along the stretcher edges (fig. VII, p. 96), produced by shrinkage of the fabric in changing conditions of relative humidity, account for the rather poor condition of the jute along the edges and tacking margins of the support.

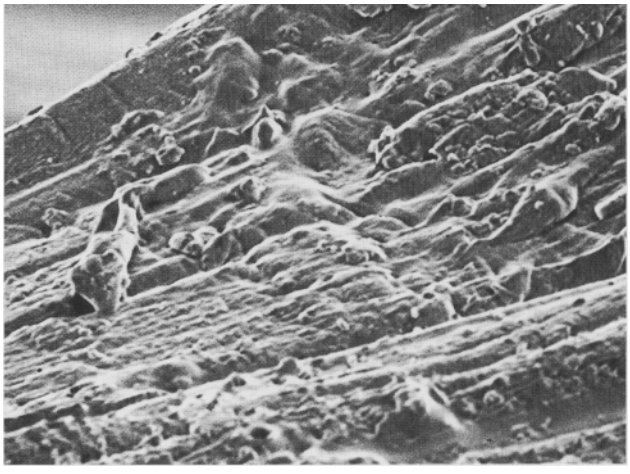
The jute support is so weak that the painting has been stored in a horizontal position. The weakness is the result of the deterioration of the jute fibres; the main cause of the damage to the fibres is the continuous tension of being mounted on a stretcher. The last treatment introduced further, irregular tensions in the support and caused more damage to the fabric.

FORMER TREATMENT

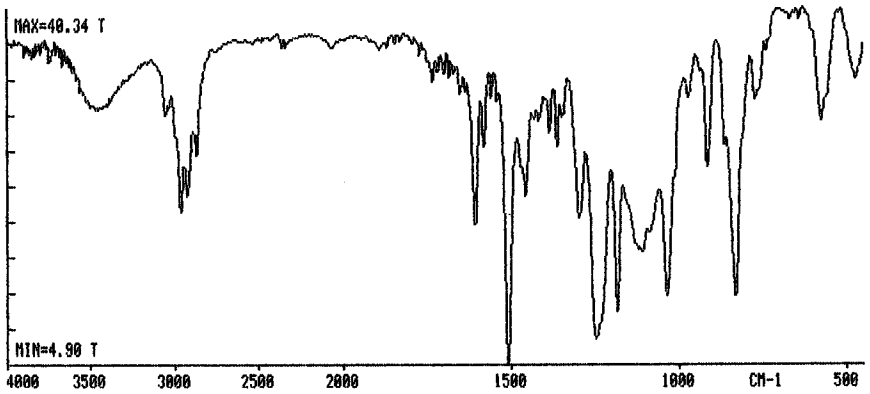
In 1980 the *Portrait of Vincent van Gogh Painting Sunflowers* was brought to the conservation studio of the Rijksmuseum because of mechanical damage – an act of vandalism. L. Kuiper, then head conservator, described the condition of the painting in his report. 'The condition of the support is extremely disquieting, the edges bent on the stretcher are torn and show holed, the tacking margins are either torn, overstretched or deteriorated. The canvas has lost its tensile strength. The threads of the canvas absorbed glue and oil from the priming as well as from the medium of the paint layer. One could say that the ground and the paint layer, which have a good adhesion with the support, are holding the fibre threads together and give them some protection. The unvarnished paint layer suffered from being unprotected for a hundred years, so that some surface grime has penetrated the rough surface texture and is part of the reason



18. SEM photomicrographs showing the rough surface of the jute fibre, 969x .



19. SEM photomicrographs showing the rough surface of the jute fibre, 3900x.



20. FTIR spectrum of the Araldit epoxy resin EGA 30172 (Ciba Geigy).

for a slightly disturbed aesthetic image of the lighter colours'.[8]

The act of vandalism was committed with a blunt object and caused two holes, one in the right blossom leaf of the upper sunflower (38 x 22 cm), the other on the right sleeve of Vincent's jacket, next to his lips (44 x 73 cm).

Loose threads from the jute fabric, taken from the edges, were used to repair the two holes in the painting; they were soaked in Araldit epoxy resin EGA 30172 (Ciba Geigy; *fig. 20*). After 24 hours, the applied fibres were thinned mechanically. The paint losses were not filled, but merely retouched with Rowney egg tempera. The damaged and weak tacking margins were consolidated on both sides with gauze attached with flattened dots of epoxy resin, spaced 1.5-2.5 cm apart. The losses in fabric support in the corners were repaired with gauze and epoxy (*figs. 21-22*).

During the application of the resin mixture, some of the hardener migrated at least 6-8 cm into the surrounding support because of the absorptive properties of the jute fibres, hardening there and causing further damage to the brittle fibres. The use of epoxy resin as a thermo-hardener for repairs and lining has clearly proved to be irreversible. The Araldit dots became so hard that they could only be reduced mechanically. They produced new tensions and breaks in the already weak threads. Moreover, the strip lining, spot-attached with epoxy, induced pocket bulges along the edges of the painting (*fig. 23*). The simple original stretcher with a centre bar was replaced with a new one, because the canvas was so slack that it was touching the bar.

The support of the *Portrait of Vincent van Gogh Painting Sunflowers* showed secondary stress lines all along the canvas perimeter, about 4 to 5 cm from the tacking edge, provoked by the strip lining (*fig. 24*). Closer examination showed flaking, cupping or cleavage only in the areas of recent fillings and retouchings. Otherwise there was good adhesion of the paint layer and ground to the jute support; this can be explained by Gauguin's sound painting technique. Staining tests of the paint cross-sections showed an isolation layer of glue, which has penetrated into the jute fibres.[9] The ground layer of lead white contains walnut oil and 5% castor oil. The latter is a non-drying oil, which may have kept the priming fairly pliable, so that it could follow the movements of the support. The only hygroscopic material in the ground is the glue isolation layer. The acidity of the lignin in the jute fibres does not seem to have had any destructive influence on the ground or paint layer.[10]

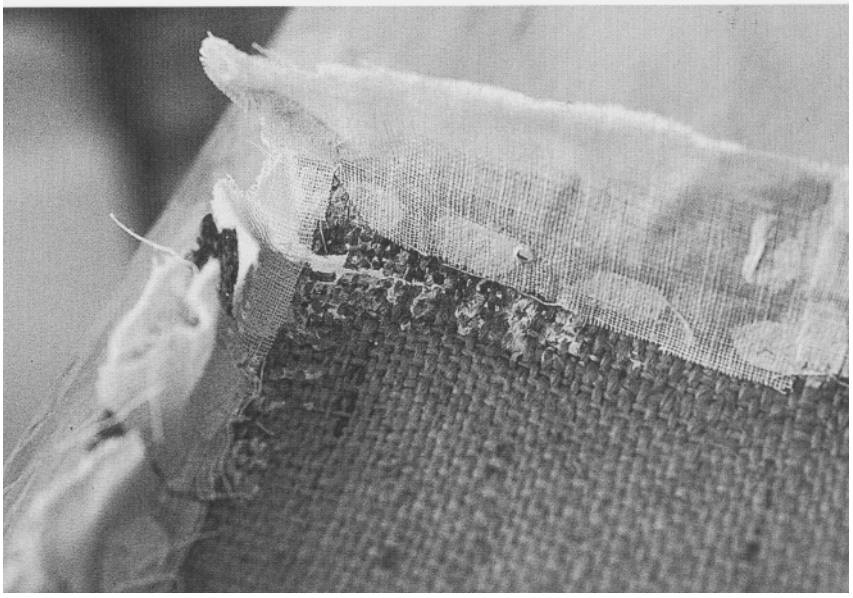
Though no coating could be distinguished optically (neither under the microscope nor with UV light) one gets the impression of an irregular, greyish veil clouding the colours of the paint layer (fig. VIII, p. 96). Staining tests of the cross-sections seemed to indicate positive for protein; however, other substances such as acrylic resins may also indicate positive. A more specific analysis, using Fourier transform infrared (FTIR), definitely identified an acrylic coating on the paint layer (*fig. 25*).[11] A possible explanation for its presence, since there is no documentation of its application to the painting, might be that the dry-looking matte surface prompted someone to protect it with a pastel fixative containing an acrylic resin.[12]

EVALUATING THE OPTIONS

Conservation of a painting on a fabric support in as weak a condition as that described above raises some basic questions and problems. These are dictated by the consistency of the fibre thread as well as that of the weave structure of the fabric.

Two options were considered. One was to reinforce the support so that the painting could be restretched, framed and displayed vertically on the wall, the other was to relax

21. Repair and consolidation treatment 1980, outer side of the tacking margins, upper right corner of the painting.



22. Repair and consolidation treatment 1980, inner side of the tacking margins; gauze strips, fixed with white dots of Araldit, upper right corner of the painting.

the painting by removing it from the stretcher and then find an appropriate alternative for a secondary support system. Reinforcement of the canvas would, in this case, mean lining or impregnation.

The hairiness of the reverse of the jute fibres enlarges the surface of the fabric and increases its capacity to absorb liquids. A low viscosity adhesive would penetrate such a fabric very easily, migrating far into the support and gluing the fibres together. This would produce a better tensile strength, but at the expense of a weaker tear strength. The fibres would lose flexibility, for they would be stiffened with glue. Such penetration might also alter the ground and the paint layer and produce an irreversible treatment.[13]

The texture, thread and fibre structure have important consequences for the adhesion of the secondary support. Any planned relining would therefore have to prevent penetration of the adhesive into the support.
To preserve the authenticity of the surface and structure of the painting, thus guaranteeing its aesthetic effects, it would be necessary to use a high viscosity adhesive with little

23. Photograph taken in raking light showing the pocket bulges and tension marks along the edges.

penetration for the lining. The result would be that the glue and the secondary support would adhere only to the outer parts of the threads and knots, in fact to the weakest fibres which could break easily, resulting in detachment of the lining.[14]

A strip lining would reduce the problems of a full lining discussed above. It would, however, only solve the immediate problem of the weakened edges under tension from the stretcher at the cost of pushing the stress inward and setting up a new problem area along the inner edge of the strip lining. This is already visible in the painting, as a result of the treatment in 1980, intensified by the stiffness of the Araldit epoxy.

In our discussions on the impregnation, consolidation, lining or strip lining of the canvas, we considered the shear, tensile and peel strengths and how they could be measured. Thanks to the creativity of Wilma Roelofs of the CL, a series of experiments was set up to study a variety of simulated cases of alterated jute with different types of supports and adhesives. Scientific tests to measure the stress relaxation, elongation, creep, elastic recovery, modulus of elasticity and bond strength could not be carried out due to a lack of equipment and facilities.[15]

We discussed the advantages and disadvantages of a few water-based, hot-melt or chemically reactive lining adhesives, which are appropriate for a range of different types of paintings, such as Beva 371 (also available as pre-prepared film), Plextol D 360, Plextol B 500, Mowilith DM 5 and DMC2. These adhesives can be made either viscous or fluid, but none of them would guarantee reversibility in our case.[16]

Another possible material was Fabri-Sil, a complete, ready-to-use lining material comprising both lining fabric and adhesive. It consists of Teflon (impregnated glass) cloth coated with a cured silicone pressure-sensitive adhesive. Instructions given for using Fabri-Sil recommend simply placing the painting onto the lining adhesive and smoothing out with the hands to secure contact.[17] A test with artificially aged jute on a sample of Fabri-Sil showed that reversibility without damaging the fibres was impossible.

Another method considered was a lining with Japanese paper and rice starch. This is a procedure which has been used on other European paintings comparable to Gauguin's Portrait of *Vincent van Gogh Painting Sunflowers*: a '*Tüchlein*' and a large jute canvas.[18] The comparison with a *Tüchlein* arose because of the similar surface appearance, such as the visible textile structure through a very thin ground and paint layer, even if the media are different: a *Tüchlein* is carried out in distemper, while this painting is oil, although the rough, dry and matte surface is not necessarily characteristic of an oil painting.[19]

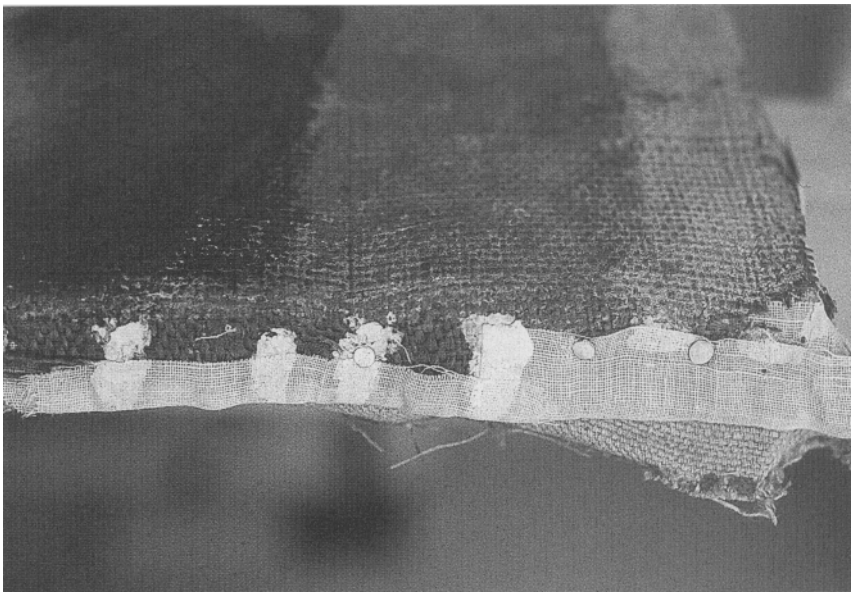
The Japanese approach was rejected because of the conservators' lack of experience, and because certain aspects of the procedure did not seem appropriate for the present

painting. The use of Japanese paper as a support requires the building up of multiple layers, which introduces the problem of high humidity during the treatment as well as a stiffening of the original canvas.[20] This support would be highly hygroscopic and still require a stretcher with the attendant problem of tension.

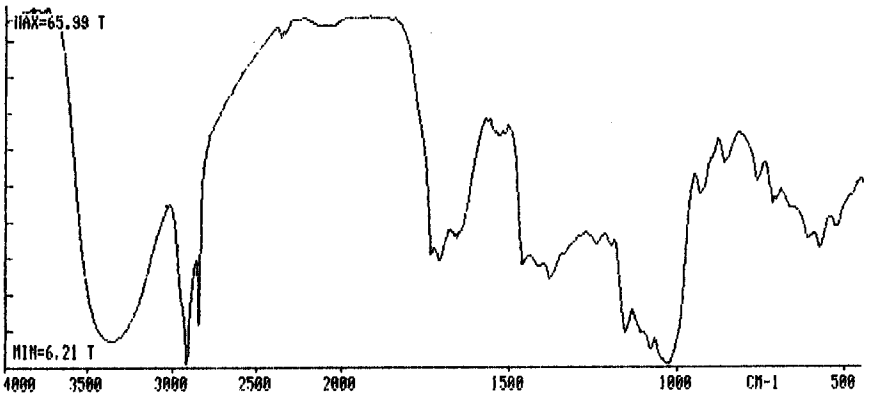
Clearly, the jute support should not be subjected to pulling or tearing stresses. In particular, the stress of vertical display would be excessive for the deteriorated and damaged top edge. These arguments led Cornelia Peres and Travers Newton to look for an alternative method of support and to focus on devising a mechanical way of supporting the painting, in which the secondary support would adhere to the jute fabric without the application of any adhesive.

Victoria Blyth-Hill, paper conservator at the Los Angeles County Museum found a very interesting solution for stabilising the flaking tendencies of works of art in pastel by creating an electrostatic attraction between the pastel particles and their support through the use of an Electrostatic Stabilising Plate (ESP). In this way the extremely fragile medium is maintained in its original condition without the risk of an irreversible treatment.[21] Although this promising method with ESP is being tested with ancient textiles there is at present no experience with paintings, but once improved it might offer a solution in future. The results of our discussions on methods which minimise stress development in a painting without lining led us back to the preliminary idea.

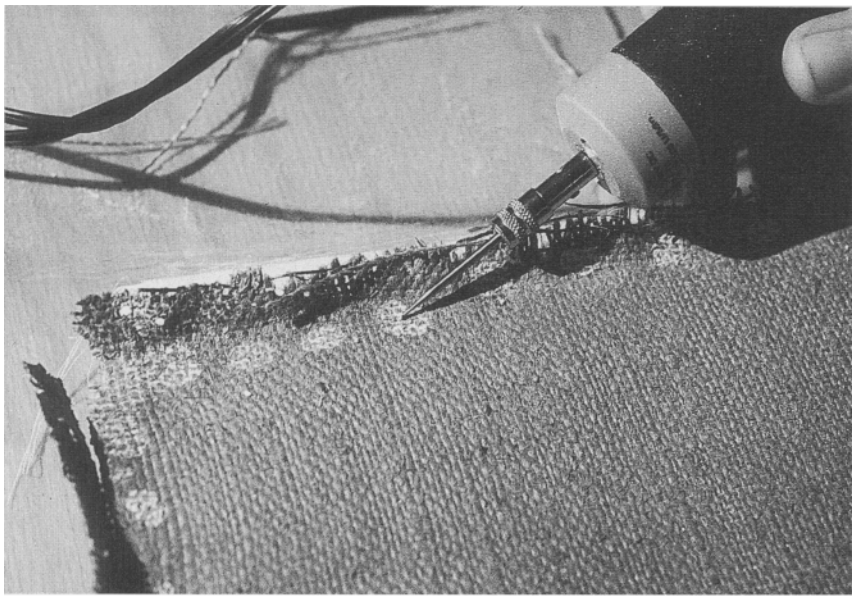
In textile conservation it is a common method to lay a fragile fabric on a rough cloth and to present it slightly tilted for viewing. Each thread of the fragile, older fabric is held by the upright fibres of the new support.[22] The question



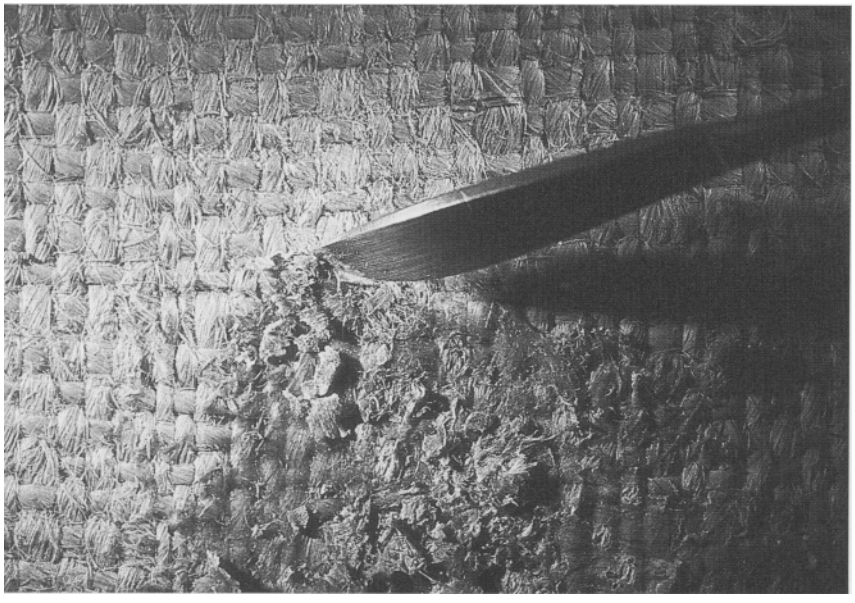
24. Detail of the upper right edge demonstrating the new tension and stress marks set up by the tacking nails.



25. FTIR spectrum of the acrylic resin.



26. Araldit repair during reduction (diminishment) with a drill along the inner edge of tacking margin.



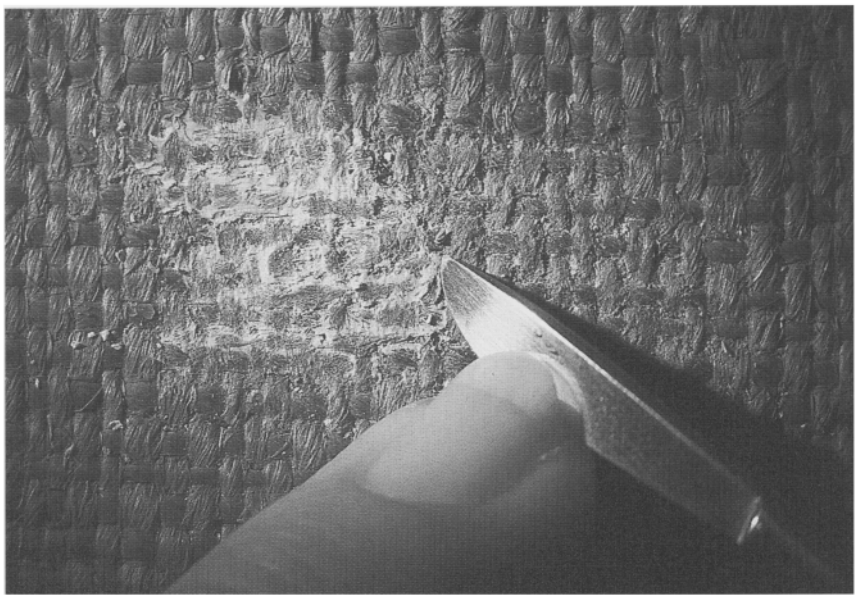
27. Removal of the old glue patch with a scalpel, 16 x.

arose as to whether such a method, which is used for small objects, could be applied to a painting of the size and weight of Gauguin's *Portrait of Vincent van Gogh Painting Sunflowers*. The jute canvas is very hygroscopic which means that it would expand or contract with any change in relative humidity. An unattached loose-lining would be risk-free if the micro-climate of the painting could be fully controlled; this could only be achieved in a display case.

In considering such an alternative support for the jute, we considered it crucial to ensure that the painting would retain its visual integrity so far as possible, and look like a conventional, stretched and framed canvas. It became essential to find an appropriate cloth for the loose backing which would give sufficient support and grip for the paint-ing to be displayed tilted at a visually acceptable angle.

The size of the painting makes it desirable to present it tilted as close to an upright position as possible without slipping. The image in the painting itself actually presents a precedent. Vincent, sitting on a chair while painting his

28. Removal of the Araldit repair with a scalpel, 16 x.



29. Reinforcement of the tacking margins along the inner edge with Renova paper.

sunflowers, with the canvas tilted back at an angle on the easel,[23] is being watched by Gauguin much like a museum visitor. Why couldn't the painting echo the tilted canvas on Vincent's easel?

Pieces of jute, aged artificially with hydrochloric acid and the application of heat, were placed on various support fabrics (cotton flannel, velvet and Velcro) and displayed at different angles for varying lengths of time.[24] The tests showed that both the cotton flannel and the Velcro provided good support for the aged jute, holding it in place at an inclination of as much as 80 degrees from the horizontal. We decided however for an inclination of 75 degrees to exclude any risk. The cotton flannel, though, would react to major changes in relative humidity. Since Velcro is made of a urea-formaldehyde resin, it does not react to changes in relative humidity. Cotton flannel is more attractive as a natural, soft and fluffy material, but its use depends on stable climate conditions, while the velcro seems to be more reliable if the climate conditions could not be guaranteed.[25]

TREATMENT

The painting was removed from the stretcher, the nails having been loosened with a special tool so that the brittle fibres would not be damaged.

Araldit EGA 30172 is one of the most stable epoxy resins and deteriorates extremely slowly. Since there is no appropriate chemical solvent for this glue, the dots of Araldit had to be reduced mechanically. During application in a more-or-less fluid consistency, the Araldit was partly absorbed by the brittle fibres and, since it flowed into the holes of the woven fabric, it enclosed some fibres entirely. The medium analyses demonstrated that the hardener of this two-part glue had penetrated into the paint layer quite far from the edge of the painting. The Araldit would only break down in warm methylene chloride, which would damage the paint layer.[26]

The gauze from the earlier strip lining, which covered the inner and outer side of the tacking margins, was cut off and the Araldit dots reduced with a small electric drill (*fig. 26*). This procedure was carried out on the outside and then the inside tacking margins, after turning the painting over. In preparation for turning the painting face down, Tylose MH 300 in 40% water was applied locally in order to consolidate the disintegrating jute fibres along the edges and secure any flaking paint.[27] A little ethyl alcohol was used first as a surfactant to facilitate the penetration of the rather viscose Tylose.

The reverse of the canvas had an old repair, a small patch of canvas fixed with animal glue (lower left corner, 10 x 4.5 cm). It was easily removed with a scalpel (*fig. 27*). The old glue had remained somewhat flexible and did not seem to have penetrated deeply into the fibres.

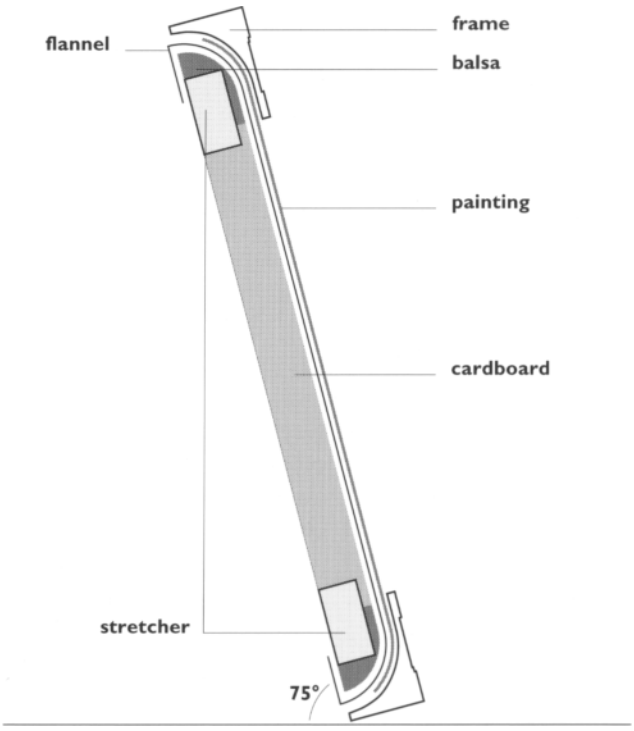
The repairs to the two areas of mechanical damage, which had been the reason for the treatment of 1980, had been carried out with Araldit. Jute fibres from the edges of the canvas, soaked in the epoxy resin, had been used to fill the damaged areas. The Araldit in these fills seems to have contained less hardener, for they were softer than the dots in the strip lining. These two repairs were also mechanically reduced as far as possible, in our treatment (*fig. 28*). While working, we noticed an astonishing flexibility of the jute support in general; this could be due to the presence of castor oil (a non-drying oil) in the ground layer.

On the other hand, the brittleness of the epoxy resin, and stretching tensions, had caused many little tears and breaks in the fibres along the tacking margin. Moreover, the original nails had become so rusty that they had bitten holes through the canvas. We mended the tears and filled the holes with jute fibres, some old and some new. As glue for the mends, we used a polyvinyl acetate mixture (1:1) of Mowilith DM 5 (harder type) and Mowilith DMC 2 (softer type) diluted with water.[28] Experience with the Mowilith types as consolidant and lining adhesive dates back to 1963, and they are still easily reversible.[29]

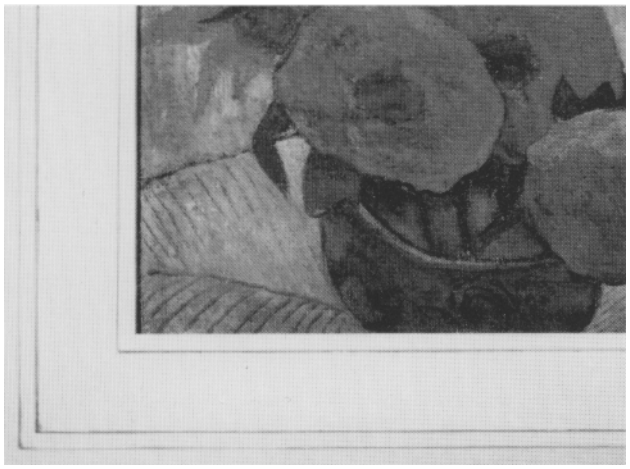
Since the tacking margins still seemed to be the weakest part of the canvas, and because they would be the most likely area to be handled and would have to support some weight in future, it was decided to reinforce them. We were looking for a light supporting fabric that would conform to the morphology of the jute, be very thin, and still have some tear strength, even in humid conditions.

Renova paper, an artificial paper made from viscose rayon and chemically identical with Japanese paper, seemed to be appropriate.[30] We used Tylose MH 1000 (1:3.5) in distilled water with 10% of the abovementioned Mowilith mixture as an adhesive.[31] We brushed the adhesive through the Renova paper on the inside tacking margins, with a small extension beyond those into the reverse of the painted canvas (*fig. 29*).

The painting was now turned over with the painted surface up and temporarily placed on a hard piece of Sintrex.[32] This had been cut to the exact inner dimensions of the



30. Build-up of the support system.



31. The *Portrait of Vincent van Gogh Painting Sunflowers* in its new frame, detail.

painting and was thick enough to allow the tacking margins to fold over at a relaxed angle. No attempt was made to flatten them. The still visible stains of the Araldit repair along the tacking margins were retouched with water-colour.

The painting can now at any time be placed on various rigid supports. In this case we used the stretcher, filled it with acid-free matting cardboard, and glued balsa strips all around the edges (*fig. 30*). The soft balsa wood can be cut easily to support the relaxed tacking margins. Since the air conditioning in the museum has now been renovated, and the painting will be shown in a display case, we could assume a stable climate and opt for a thick, fluffy, cotton flannel as the supporting cloth to keep the original canvas in position.[33] The flannel will be wrapped around the rigid support.

A new frame with its rabbet following the angle of the relaxed tacking margins, gives extra protection against slippage (*fig. 31*). The shape and colour of the new design was inspired by several paintings by Gauguin with framed pictures on the wall in the background.[34] Gauguin obviously preferred quite large frames with a flat profile, sometimes slightly accentuated by having raised edges, and off-white in colour in line with the Impressionist ideas on framing.[35]

The problem of reducing the surface grime and Acrylic coating still remains. An attempt at cleaning was made with a very viscous, acetone-Carbopol-Ethomeen mixture, with 2% Lexein and a few drops of benzol alcohol, based on recent research by Richard Wolbers. The cleaning effect was minimal, and a decision on whether or not to proceed with cleaning has yet to be made.

NOTES

We owe Judith Hofenk de Graaff a special word of thanks for gathering data of various kinds. She also integrated parts of our joint discussions in her report, '*Research on the Possibilities of Conserving Gauguin's Portrait of Vincent van Gogh Painting Sunflowers*', which was commissioned by the Rijksmuseum Vincent van Gogh, C.M. Peres, research no. 88/062, documentation file no. 88/11. The results of the research are based on the efforts of many individuals who collaborated in the development of the conservation options: Carin van Nes (textile conservator), M.F.S. Karreman (FTIR), W. Roelofs (gliding tests), M. de Keijzer (cross-section analysis).

I am particularly grateful to IJsbrand Hummelen, who not only supplied helpful suggestions as regards the text of this essay but also made a valuable contribution to the discussions on the way in which the canvas should be exhibited. The collaboration with Vojtěch and Travers provided a unique experience both professionally and personally.

A summary of the conservation treatment can be found in Vojtěch Jirat-Wasiutyński and Travers Newton, 'Paul Gauguin's Paintings of Late 1888: Reconstructing the Artist's Aims from Technical and Documentary Evidence', in *Appearance, Opinion, Change: Evaluating the Look of Paintings*, London 1990, pp. 26-35.

1. See the contributions by H. Travers Newton, notes 3 and 32, and Cornelia Peres, 'On Egg-White Coatings', note 28.

2. See 'Interdisziplinäres Gespräch mit Mechtild Fluty-Lemberg, Leiterin der Abteilung Textielrestaurierung der Abegg Stiftung Bern: "Kann der Gemälderestaurator für die Konservierung textieler Bildträger von den Erfahrungen des Textielrestaurators gewinnen?"', *Vortragstexte der zweiten Fach- und Fortbildunstagung der Fachklasse Konservierung und Restaurierung der Stadt Bern*, Bern 1983, pp. 31-33.

3. Prior to the meeting, Vishwa Mehra, then at the CL, confirmed in a letter C. Peres's opinion regarding the risk of a total restoration, which should be avoided for as long as possible.

4. All these issues are pointed out in the reports made after the committee meeting.

5. See Ashok Roy's letter of 5 August 1987 on the analysis results (Rijksmuseum Vincent van Gogh, documentation file). With thanks to Ms Dorothy Catling of the Metropolitan Police Forensic Laboratory, London, for her detailed analysis of a fibre sample.

6. For the characteristics of jute see Beatrix Haaf, 'Industriell vorgrundierte Malleinen: Beiträge zur Entwicklungs-, Handels- und Materialgeschichte', *Zeitschrift für Kunsttechnologie und Konservierung* 1 (1987), no. 2, pp. 27ff; A. Herzog, *Mikrographischer Atlas der technisch wichtigen Planzenfasern*, Berlin 1955, p. 349; G.E. Linton, *The Modern Textile Dictionary*, 2nd ed., New York 1963, p. 504; E.A. Posselt, *The Structure of Fibres, Yarns and Fabrics*, Philadelphia 1892, p. 209.

7. See also note 5. Compared to hemp and flax, jute contains four times as much lignin, see J.W.S. Hearle *et al.*, *Fibre Structure*, London 1963, pp. 282ff and 422ff.

8. Another possible reason for this phenomenon is the acrylic coating (see text below) and some pigment discolouration; see the contribution by H. Travers Newton, and H. Kühn and

M. Curran, 'Chrome Yellow and Other Chromate Pigments', in R.L. Feller (ed.), *Artists' Pigments: a Handbook of Their History and Characteristics*, Cambridge etc. 1986, pp. 190-91.

9. These tests were conducted by M. de Keijzer of the CL.

10. See Ashok Roy's letter (note 6). It is possible that the castor oil was added to the medium of the paint layer and had penetrated into the ground (see the contribution by H. Travers Newton).

11. The FTIR analysis was done by Riet Karreman of the CL.

12. Acrylics as coatings for paintings are commercially available, and have been in use since the 1930s: C.V. Horie, *Materials for Conservation, London* 1987, pp. 106ff. IJsbrand Hummelen suggested that it could be a matte acrylic varnish as produced by Talens as a pastel fixative spray.

13. S. Landri, *The Textile Conservation Manual*, London 1985, pp. 42ff and 96ff.

14. For a complete list of lining literature from the end of the eighteenth century up until 1982, see U. Schiessl, 'Kleine Bibliographie zur Literatur über die Behandlung textieler Bildträger in der Konservierungstechnik: Beiträge zur Konservierung textieler Bildträger', *Vortragstexte der zweiten Fach- und Fortbildunstagung der Fachklasse Konservierung und Restaurierung der Stadt Bern*, Bern 1983, pp. 130ff.

This solution goes against the basic conservation principle that the lining support and adhesive should always be weaker than the support being lined, in order to make the procedure reversible. For the principle of a weaker supporting canvas of a natural fibre material see also 'Interdisziplinäres Gespräch', cit. (note 2), pp. 29ff. For additional literature see *Preprints of the Contributions to the Paris Congress: Adhesives and Consolidants*, 2-8 September 1984, organised by the IIC.

15. Gustav A. Berger and William H. Russell, 'Some Conservation Treatments in the Light of the Latest Stress Measurements (Preliminary Report),' ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, pp. 127ff; Debra Daly and Stefan Michalski, 'Methodology and Status of the Lining Project, CCI', ibid., vol. 1, pp. 145ff; Susan Bradley, 'Strength Testing of Adhesives and Consolidants for Conservation Purposes', *Adhesives and Consolidants*, IIC, Paris 1984, pp. 22ff.

16. Juliet J. Hawker, 'The Bond Strength of Two Hot Table Lining Adhesives: Beva 371 and Plextol D 360', ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, pp. 161ff; Winfried Heiber, 'Die Doublerung mit Geweberasterhaftung', *Zeitschrift für Kunsttechnologie und Konservierung* 1 (1987), no. 2, pp. 72ff. Plextol, a product manufactured by Röhm and Haas, is commercially available through Lascaux, a supplier of art materials.

17. Robert E. Fieux, 'Silicone Polymers for Relining of Paintings', *Adhesives and Consolidants*, IIC, Paris 1984, pp. 46ff; Alan Phenix et al., 'Lining without Heat or Moisture', ICOM *Committee for Conservation*, 7th Triennial Meeting, Copenhagen 1984, vol. 2, pp. 42ff.

18. E. Bosshard, 'Tüchleinmalerei: eine billige Ersatztechnik?', *Zeitschrift für Kunstgeschichte* 45 (1982), pp. 31-42. P. Vandenbroek, 'Laatmiddeleeuwse doekschilderkunst in de zuidelijke Nederlanden: repertorium der nog bewaarde werken', *Jaarboek van het Koninklijk Museum voor Schone Kunsten, Antwerpen*, 1982, pp. 29-60; R.E. Straub, 'Tafel und Tüchleinmalerei des Mittelalters', *Reclams Handbuch der künstlerischen Techniken*, vol. 1, Stuttgart 1984, pp. 150ff; C.M. Peres 'Materialkundliche, wirtschaftliche und soziale Aspekte zur Gemäldeherstellung in den Niederlanden im 17. Jh.', *Zeitschrift für Kunsttechnologie und Konservierung* 2 (1988), no. 2, pp. 272ff.

19. A. Philippot, N. Goethghebuer and R. Guislain-Wittermann, 'L'Adoration des Mages de Breugel au Musée des Beaux-Arts des Bruxelles: traitement d'un "Tuechlein"', *Bulletin de l'Institut Royal du Patrimoine Artistique*, Brussel 11 (1969), pp. 5-33.

The Japanese lining method was also used for *Orphée* by J.J. Gaillard (Brussels, Ministère de la Communitée Française), which is on a large jute canvas (230 x 200 cm) consisting of two pieces sewn together. A publication on the treatment is in preparation. We wish to thank Regine Guislain-Wittermann of L'Institut Royal du Patrimoine Artistique in Brussels for her generous and interesting exchange of information and ideas.

20. For the influence of humidity on canvas see V. Schaible, 'Neue Überlegungen zur Feuchtigkeit am Leinwandbild', *Zeitschrift für Kunsttechnologie und Konservierung* 1 (1987), no. 1, pp. 75ff, and G. Hedley 'Relative Humidity and the Stress/Strain Response of Canvas Paintings: Unaxial Measurements of Naturally Aged Samples', *Studies in Conservation* 33 (1988), pp. 133ff.

21. V.S. Blyth, 'Electrostatic Stabilizing Plate (ESP)', AIC *preprints*, 6th Annual Meeting, Fort Worth, Texas, 1-4 June 1978.

22. Recommended by Carin van Nes, textile conservator at the CL, who was a great help in finding appropriate materials for the loose support and adhesives for the reinforcement of the tacking margins.

23. We would like to thank Ernst van de Wetering for his suggestions.

24. Addition to the research report by W.G.T. Roelofs, test results with supporting materials, 8 June 1988.

25. If necessary, additional equipment for a display case will be incorporated, based on the scientific research report, 'Development of a Prototype Storage and Display Case for the Royal Mummies in the Egyptian Museum of Cairo', Getty Conservation Institute, Marina del Rey, 1989. Some very practical parameters had been defined in the basic concept, such as the independence of any mechanical or electrical systems, as little maintenance as possible, and a design which can be manufactured in many countries without becoming too expensive. It is necessary to investigate whether the inner case design is appropriate for *Gauguin's Portrait of Vincent van Gogh Painting Sunflowers*, since low relative humidity and oxygen might affect some of the pigments. On the other hand, it would drastically retard further deterioration of the jute.

26. Information supplied by Judith Hofenk de Graaff. Methylene chloride (CH_2Cl_2), is a solvent for fats, oils and resins. Apart from the fact that it is very toxic, it could break up the medium of the paint layers.

27. Tylose MH 300 is a less viscous methyl cellulose than Tylose MH 1000, and therefore penetrates better.

28. Recommended by Carin van Nes (see note 22), who kindly demonstrated the application method and allowed us to use her studio facilities and equipment for tests on two types of dummy, prepared by Travers Newton and Cornelia Peres.

29. *Mowilith Handbuch*, Farbwerke Hoechst AG, 5th ed., Frankfurt 1970, table 234, DMC 2, pp. 115, 129-30, 135, 140, 152, 159, 183-84, 189, 199; DM 5, pp. 115, 119, 126, 130, 135, 145, 154-55, 172, 183-84, 193, 195-96, 199, 204. See also Horie, op. cit.

(note 13), p. 95, Landri, op. cit. (note 14), pp. 97 and pp. 183ff; D. Blum, 'An Evaluation of Some Uses of Synthetic Resins in Textile Conservation', *Proceedings of the Symposium 'Resins in Conservation'*, Edinburgh 1983, pp. 8-1 to 8-8; J. Verdu et al., 'Adhesives for the Consolidation of Textiles', *Adhesives and Consolidants*, IIC, Paris 1984, pp. 64-69; L. Maschelein-Kleiner *et al.*, 'Influence of Adhesives on the Conservation of Textiles', ibid., pp. 70ff; E. de Witte *et al.*, 'Influence of the Modification of Dispersions on Film Properties', ibid., pp. 32ff (including list of suppliers) mentions the solubility in 2-Propanol; R. Howells *et al.*, 'Polymer Dispersions Artificially Aged', ibid., pp. 36ff; E. Jägers, 'Synthetische Materialien für die Malschichtfestigung', *Deutscher Restauratoren Verband, Mitteilungen* 1984/85, no. 6, pp. 26ff.

30. Renova was recommended by the paper conservator Charlotte Wolff, then at the CL. See also research report no. 14/1232 by the TNO Fibre Institute, Delft, 1967. The idea of reinforcing the tacking margins with Japanese tissue was also suggested by Margaret Ellis, Director of the Conservation Program at New York University.

31. J. Hofenk de Graaff, 'Hydroxy Propyl Cellulose, a Multi-purpose Conservation Material', ICOM *Committee for Conservation*, 6th Triennial Meeting, Ottawa 1981, no. 9, pp. 1-7. For the combination of a PVAC (5-10% Vinnamul 3252) see also Lynn Morrison 'The Treatment, Mounting and Storage of a Larger Group of Archeological Textile Fragments', ICOM *Committee for Conservation*, 8th Triennial Meeting, Sydney 1987, vol. 1, pp. 391ff.

32. Sintrex is a polyethylene covered on both sides with acid-free cardboard.

33. See 'Interdisziplinäres Gespräch', cit. (note 2), for the reasons for preferring a natural fibre support.

34. *Still Life with Vase of Japanese Peonies and Mandolin* (Paris, Musée d'Orsay); Portrait of Madeleine Bernard (Grenoble, Musée de Grenoble); *Portrait of Schuffenecker's Family* (Paris, Musée d'Orsay); *Portrait of a Woman with a Still Life by Cézanne* (Chicago, The Art Institute of Chicago); *Self-Portrait with Hat* (Paris, Musée d'Orsay), which has a yellow, not white, frame.

35. For a comparable contemporary example see the original frame of Émile Bernard's *Breton Women in the Meadow* (Switzerland, private collection).

Colophon

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